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the glass industry

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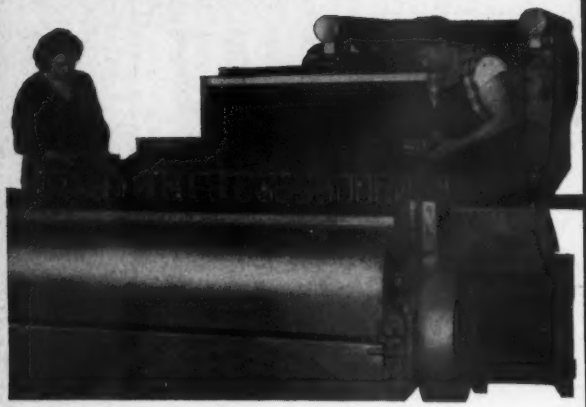

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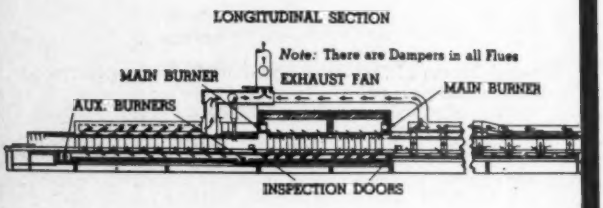

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the glass industry
VOLUME 36, NUMBER 10, OCTOBER, 1955

Comparison of the Surface Durabilities of Some Commercial Bottle Glasses

By H. E. SIMPSON
N. Y. State College of Ceramics, Alfred University, Alfred, New York

I. Introduction

AMONG THE PUBLISHED PAPERS on the surface durability of flat glass[1,2,3] have been those dealing with plate and window glass and ground and polished optical reticules. In these papers it was shown that water vapor, in the form of a mild surface fog, alternately condensed and evaporated on the surface of the sample owing to a deliberate and automatic change in the temperature of the test chamber during a two-hour time cycle. The temperature was varied only a few degrees above or below the saturation point of 55°C. This cyclic routine produced marked deterioration on the surface of the glass and two important factors contributing to this breakdown were believed to be (1) condensation of moisture and (2) drying of the surface. It should be emphasized that in these investigations the condensation of moisture was not sufficient to produce a runoff, which would have removed the products of weathering.

This deterioration of the glass surface, brought about by artificial weathering produced through cyclic control, was then measured in terms of per cent haze. The total transmission and the amount of scattered light of the weathered sample were measured by means of a photoelectric haze meter, the relative amount of scattering being considered as indicative of the amount of haze or surface deterioration. The results were found to be especially useful when applied to flat glass.

The procedure described above, however, could not be used with samples that were either uneven in thickness, or had curved surfaces, such as bottles, containers, ampoules, and certain pressed ware. It was found that the specimen acted as a lens, either concentrating or scattering the light source, depending on its presentation to the light beam. It was apparent that some form of a flat copy or replica of the curved surface would be necessary to interpret the corrosion of such samples by means of the haze meter.

In order to extend and broaden the usefulness of the already developed procedure to include curved surfaces, a replica technique was developed. This method consisted in using a liquid plastic composed of Vinylite dissolved in methyl isobutyl ketone or acetone. A desirable replica of the previously weathered samples of curved glass, for example a bottle glass, was produced by dipping the sample in the plastic solution. After careful drying under controlled conditions, the plastic film was stripped from the surface with the aid of a razor blade to give an accurate reproduction of the corroded glass surface. The flat-plastic replica of the corroded-curved bottle surface was then mounted in a cardboard folder with an aperture approximately 1½ in. in diameter. The degree of surface deterioration, as shown by the replica, was then determined with a photoelectric haze meter. Details of this procedure are given in a previously published paper.[4]

In order to be reasonably sure that all samples were clean before they were subjected to weathering tests they were first scrubbed thoroughly with a cotton swab dipped in a thick slurry or paste of calcium carbonate and distilled water. It was found desirable to rub briskly each side of the sample for one minute to insure uni-

[1]H. E. Simpson, "Method of Measuring Surface Durability of Glass," Am. Ceram. Soc. Bull., 30 (2), 41-45 (1951).
[2]H. E. Simpson, "Some Factors Affecting Testing of Surface Durability of Flat Glass," J. Am. Ceram. Soc., 36 (4) 143-46 (1953).
[3]H. E. Simpson, "Surface Durability of Optical Glass," J. Soc. Glass Technol., 37, 249-55 (1953).
[4]H. E. Simpson, "Adaptation of Replica Technique to Measurement of Surface Durability of Glass," J. Am. Ceram. Soc. 38 (2) 81-85 (1955).

form cleaning. The brisk rubbing was followed by a thorough rinsing in hot and cold tap water aided by rubbing with a clean cotton swab. The samples were then held by tongs to avoid contamination and washed with distilled water. After this washing, each sample was then dried by means of a jet of filtered air (the air jet was approximately 1/8 in. in diameter and operated under 15 lbs. air pressure). The air jet was first directed at the edge of the sample and then slowly worked across the entire surface blowing the film of water from the surface of the glass very rapidly and thus leaving practically no evaporated residue. Such a technique was considered practical to insure a chemically clean surface prior to the weathering test, especially when the samples had been subjected to considerable handling during cutting and preparation. It should be pointed out that the calcium carbonate cleaning was used as a "precaution" only, to insure a chemically clean surface on the glass prior to testing. There was no evidence that this treatment caused any alteration in the surface of the sample. As a matter of fact, cleaning with calcium carbonate was found to be superior to many other methods of cleaning such as pumice, alcohol, carbon tetrachloride, detergents, and various other cleaning solutions. The question had been raised, however, whether or not treatment with calcium carbonate slurry might alter the surface of the glass and influence its weathering characteristics. In the present investigation, therefore, all tests were made on glass samples cut from the walls of commercial containers as received from the plant. No preparation or alteration of the surface was practiced such as scrubbing or cleaning. The results of this direct preparation were therefore compared with those in which careful washing with calcium carbonate slurry was practiced. The results of tests on 12 different commercial container glasses are given.

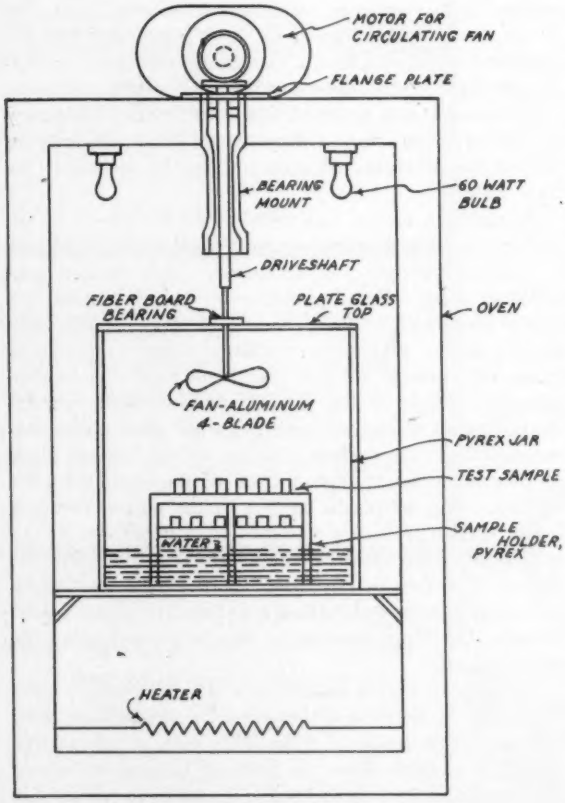

Fig. 1. Haze Test Oven.

II. Description of the Apparatus

(a) *Preparation of Samples for Haze Tests*

All the samples used in these tests were commercial products obtained from industry. The samples were taken from bottles and containers received directly from the production line. These containers had been carefully packed in cardboard cartons after annealing and arrived at the laboratory in excellent condition. Careful handling was practiced in cutting the samples from the bottles to prevent finger marks, grease, and extraneous dirt from accumulating on their surfaces. The 2 x 2 samples were cut from the sides of the bottles using a hot wire cutter. The remainder of the sample was crushed and used for powder durability tests.

A cutting apparatus was constructed using either a No. 18 Chromel or a Kanthal "A" wire (1.40 ohms per foot), 12 to 18 inches in length. The wire was supported by posts approximately one foot apart, mounted rigidly on a wooden base. A powerstat variable transformer with a maximum output of 2.5 K.V.A. and a maximum current output of 9 amperes was used to control the current. The power was supplied from a 110 volt, 60 cycle A.C. line.

Identification numbers were marked with a diamond point in the right hand corner of each sample. After this careful preparation, approximately 12 samples were placed in the humidity cell and removed at stated time intervals.

Upon completion of the run in the humidity cell, the exposed samples were washed with distilled water and lightly scrubbed by means of a cotton swab to remove all water soluble salts. The samples were then thoroughly dried by means of a jet of filtered air under 20/psi pressure directed across the surface of the sample. In the case of curved or opaque samples where a plastic replica of the corroded surface was necessary for haze meter evaluation, the weathered sample was dipped in a vinylite plastic solution. The samples were then placed on racks, allowed to dry for 24 hours, and dipped once again. Care was taken to avoid too rapid drying in order that the replica coating would be as smooth as possible.

After the samples had completely dried, the plastic coating was stripped from the glass and the replica mounted in a 3 inch square heavy manila paper holder with an aperture 1.5 inches in diameter. Each card was then marked with an identification number and made ready for haze determination.

(b) *Oven and Humidity Cell for Weathering Tests*

A Pyrex (No. 7740) circular battery jar, 12 inches in diameter, covered with a Pyrex (No. 7740) lid, was used as the humidity cell. The samples were then supported on specially made Pyrex (No. 7740) or plastic racks. These racks held the samples approximately 3 inches above the surface of the water in the cell.

The cell was then placed in a Precision Scientific Com-

pany 100 watt oven to insure proper temperature control. Four 60 watt bulbs attached to the inside roof of the oven and connected in parallel with the primary heater aided in providing temperature uniformity. The humidity cell is shown in Figure 1.

Cycling was accomplished by means of a Telechron cam timer, geared to deliver one revolution every 2 hours. This arrangement turned the oven "on" for one hour and "off" each second hour. A bi-metallic thermostat governed the temperature during the "on" cycle. This cycling caused the water alternately to condense on and evaporate from the test samples. The temperature cycle produced within the humidity cell is shown in Figure 2. Visible fogging began after about 30 minutes of cooling and ended about 60 minutes later. An important feature of this method was that the products of weathering remained in place on the glass surface being tested.

The air within the cell was kept in constant circulation in order to eliminate any runoff effects of the water from condensing on the glass surfaces. This constant circulation was maintained by a 160 rpm. fan located on top of the oven, which operated during both the "on" and "off" cycles of the run (see Fig. 2).

(c) *Haze Meter*

After exposure in the humidity chamber for varying lengths of time, the haze or degree of deterioration was measured by a haze meter, the details of which are shown in Figure 3. The apparatus consisted of a shielded electric light bulb and a photocell 18 inches apart. The light source consisted of a 6.5 V. S-8 bulb and was enclosed in a cylindrical shield, blackened on the inside. In order to have the light concentrated in a small area, an aperture 1 inch in diameter was constructed at the end of the cylinder. A 6 volt storage battery was used to operate the light source. The intensity of the lamp was adjusted by means of 3 rheostats connected in parallel.

The photocell activated a galvanometer with a sensitivity of 1.5 UV/mm, a resistance of 27 ohms, and a period of 3.2 seconds. Two resistances of 50 and 60 ohms were placed in parallel with the galvanometer.

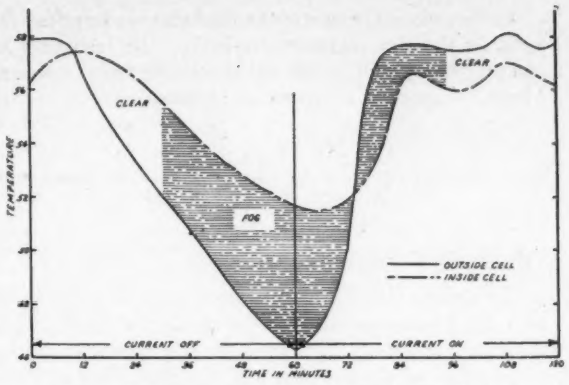

Fig. 2. Temperature Variations During Cycling.

(d) *Determination of the Haze*

The haze meter measured essentially the amount of parallel light that was scattered or otherwise deflected owing to the surface deterioration on the corroded glass sample. When the sample was in front of the photocell, all transmitted light, both directly transmitted and diffusely transmitted as scattered light, affected the photocell. But when the sample was placed in front of the light source, the light which was scattered by the haze was essentially lost, and the photocell received only the directly or parallel transmitted light. From the definition of haze:

$$\% \text{ Haze} = \frac{T - T_R}{T} \times 100 = \frac{T_d}{T} \times 100$$

where T = total light transmitted
T_R = amount of light transmitted in a straight line
T_d = amount of light transmitted in all directions except rectilinearly

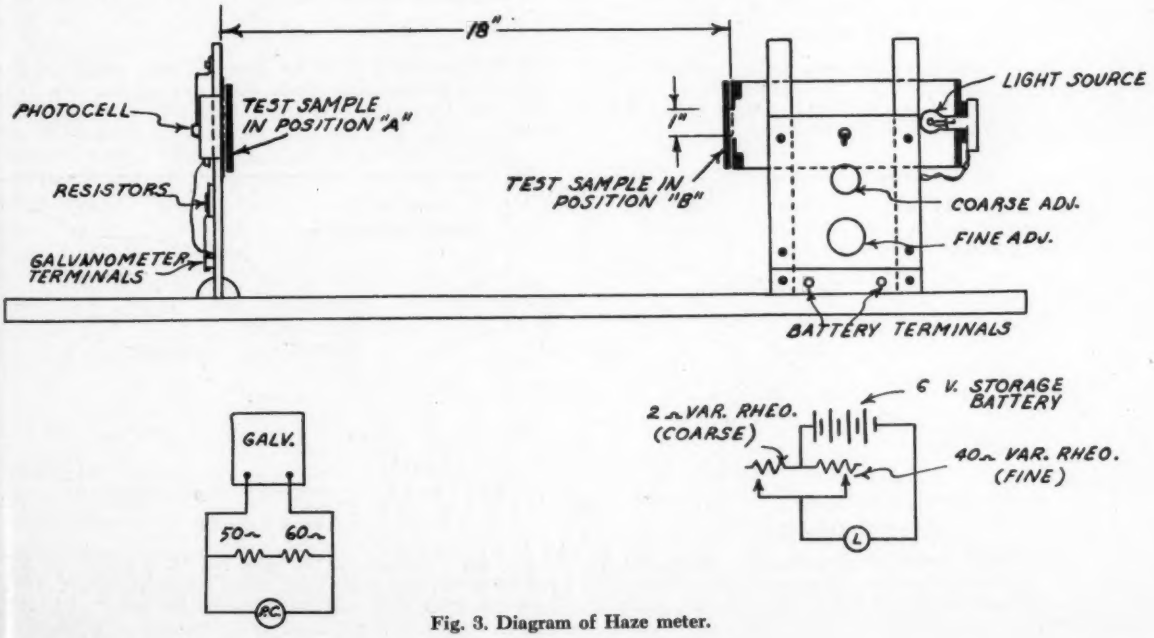

Fig. 3. Diagram of Haze meter.

In this, the difference in the photocell readings for the glass in the two positions divided by the reading with the sample in front of the cell times 100 was the present "haze." Expressed in terms of an equation:

(e) *Powder Durability Tests*

$$\% \text{ Haze} = \frac{A-B}{A} \times 100$$

(e) *Powder Durability Tests*

The powder durability tests were made in accordance with the recommendation of the committee on chemical durability of glass.[5] Extreme care was necessary in the preparation of the samples and the procedure outlined below was carefully followed. Three or four 30 to 40 gram samples were crushed in a specially hardened steel mortar. The mortar contained a flat-bottomed cavity approximately 2 inches in diameter. The pestle was struck 3 or 4 times with a hammer and the crushed glass was then transferred to a nest of sieves of 20, 40 and 50 meshes to the inch, of which the last two gave particles ranging in size from 0.295 to 0.417 mm. After it was shaken by hand for 2 minutes, the glass on the 20-mesh and the 40-mesh sieves was again crushed and the screening process repeated.

The material on the 50-mesh sieve was transferred to a sheet of paper; any particles of iron were removed with a magnet. The powdered sample was then put into a basket made of 80-mesh copper screen, agitated for one minute in distilled water and one minute each in 2 changes of alcohol, dried at 110° and cooled in a desiccator.

A 10-gram sample of glass was then transferred to a 200 ml. Erlenmeyer-Pyrex flask, 50 ml. of $N/_{50}$ H_2SO_4 added, stoppered with a one-hole stopper and immersed to a depth of about 2 in. in a water bath maintained at 90° C. After 4 hours the sample was quickly cooled and phenolphthalein-red indicator was added. The sample was then titrated with 0.02N NaOH, free from CO_2, until about 1 ml. excess after which it was titrated with 0.02N H_2SO_4. The results were expressed in percentage Na_2O extracted by the following formula:

$$\text{Percentage } Na_2O \text{ extracted} = \frac{(\text{ml.}N/_{50}\ H_2SO_4 \text{ used} - \text{ml.}N/_{50}\ \text{NaOH used}) \times .00062 \times 100}{10}$$

[5] "Report of the Committee on Chemical Durability of Glass," Amer. Ceram. Soc. Bull., 14 (5) 181-84 (1935).

III. Experimental Results

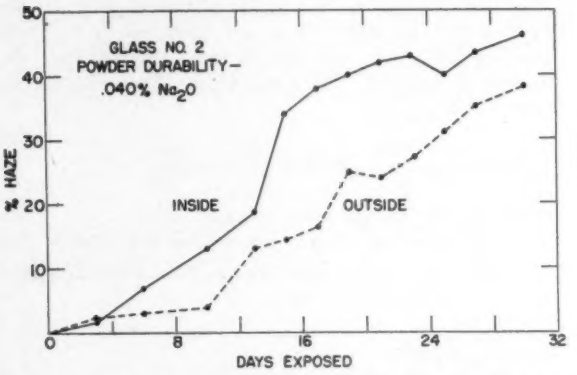

Fig. 4. Haze meter curve for glass No. 2 in which the RO content is predominantly CaO. Glass composition: SiO_2 72.1, R_2O_3 1.9, CaO 10.5, MgO 0.65, BaO 0.0, Na_2O 14.4, K_2O 0.19, MnO 0.15%.

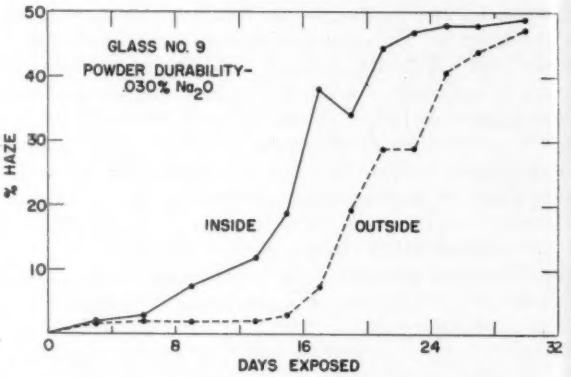

Fig. 6. Haze meter curve for glass No. 9 in which the RO content is predominantly CaO. Glass composition: SiO_2 71.3, R_2O_3 2.6, CaO 11.3, MgO 0.16, BaO 0.0, Na_2O 14.3, K_2O 0.23%.

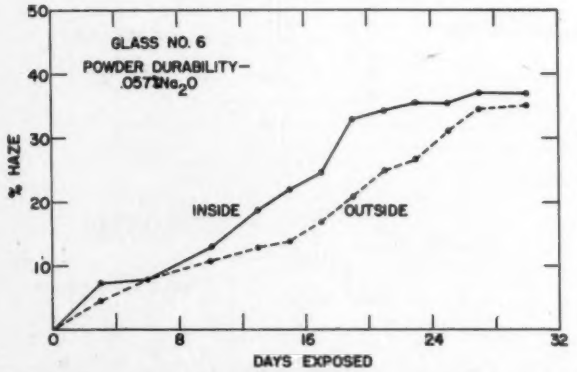

Fig. 5. Haze meter curve for glass No. 6 in which the RO content is predominantly CaO. Glass composition: SiO_2 71.8, R_2O_3 1.8, CaO 12.2, MgO 0.12, BaO 0.63, Na_2O 13.5, K_2O 0.07, MnO 0.0%.

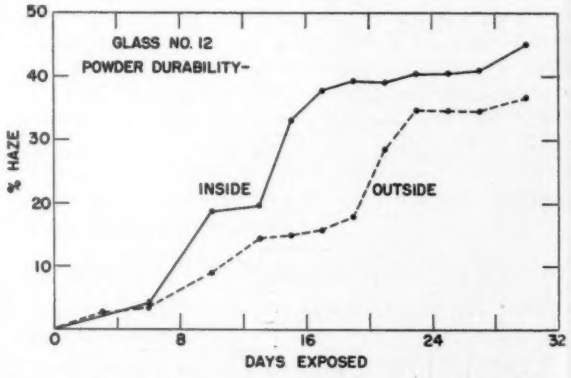

Fig. 7. Haze meter curve for glass No. 12 in which the RO content is predominantly CaO. Glass composition: SiO_2 71.7, R_2O_3 1.8, CaO 12.2, MgO 0.11, BaO 0.62, Na_2O 13.4, K_2O 0.14%.

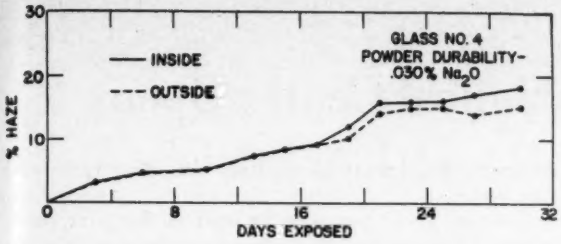

Fig. 8. Haze meter curve for glass No. 4 in which the RO content is divided between CaO and MgO. Glass composition: SiO_2 71.7, R_2O_3 1.9, CaO 11.2, MgO 1.1, BaO 0.62, Na_2O 13.1, K_2O 0.37%.

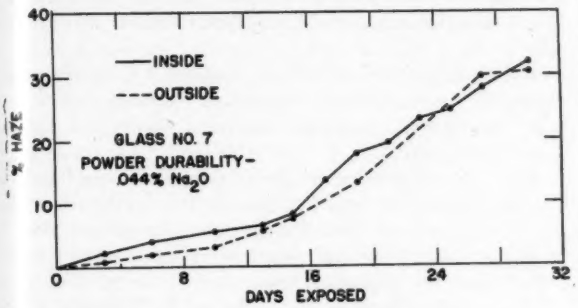

Fig. 9. Haze meter curve for glass No. 7 in which the RO content is divided between CaO and MgO. Glass composition: SiO_2 71.2, R_2O_3 1.5, CaO 10.2, MgO 2.8, BaO 0.62, Na_2O 13.4, K_2O 0.29%.

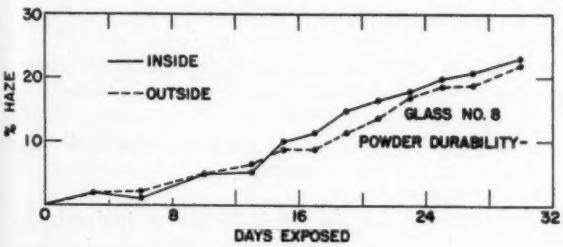

Fig. 10. Haze meter curve for glass No. 8 in which the RO content is divided between CaO and MgO. Glass composition: SiO_2 71.2, R_2O_3 1.4, CaO 10.7, MgO 2.8, BaO 0.64, Na_2O 13.1, K_2O 0.14%.

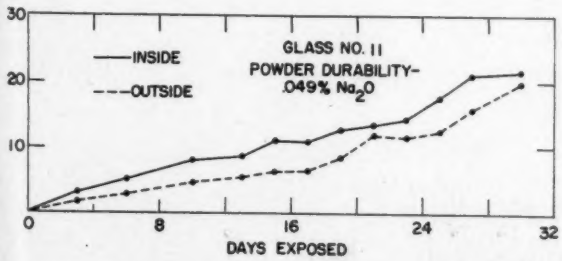

Fig. 11. Haze meter curve for glass No. 11 in which the RO content is divided between CaO and MgO. Glass composition: SiO_2 71.4, R_2O_3 1.4, CaO 11.0, MgO 2.7, BaO 0.0, Na_2O 13.0, K_2O 0.28%.

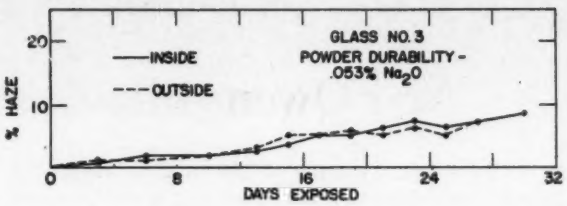

Fig. 12. Haze meter curve for glass No. 3 in which the ratio of CaO:MgO approaches that of dolomite ($CaCO_3.MgCO_3$) Glass composition: SiO_2 71.0, R_2O_3 1.4, CaO 8.1, MgO 5.6, BaO 0.62, Na_2O 12.9, K_2O 0.35%.

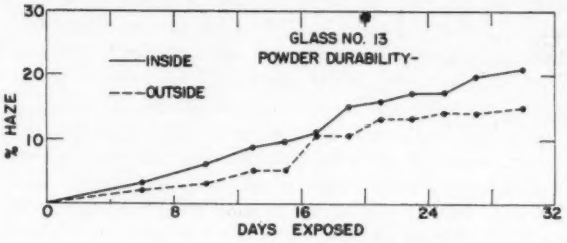

Fig. 13. Haze meter curve for glass No. 13 in which the ratio of CaO:MgO approaches that of dolomite ($CaCO_3.MgCO_3$) Glass composition: SiO_2 71.3, B_2O_3 1.8, CaO 6.3, MgO 4.2, BaO 0.98, Na_2O 14.9, K_2O 0.07, Volatiles 0.40%.

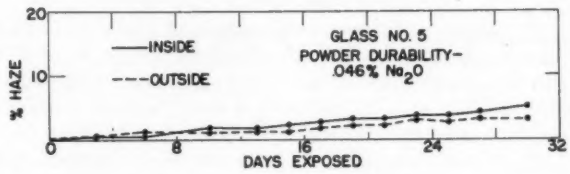

Fig. 14. Haze meter curve for glass No. 5 in which the Al_2O_3 content is exceptionally high. Glass composition: SiO_2 63.8, R_2O_3 9.6, CaO 8.9, MgO 0.15, BaO—, Na_2O 15.5, K_2O 2.0%.

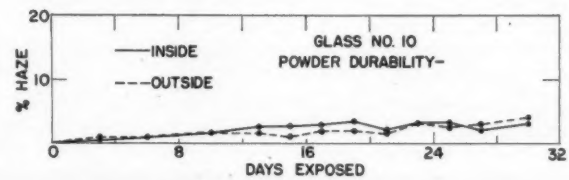

Fig. 15. Haze meter curve for glass No. 10 in which the Al_2O_3 content is exceptionally high. Glass composition: SiO_2 72.3, Al_2O_3 3.4, Fe_2O_3 0.85, CaO 3.9, MgO 3.1, Na_2O 14.5, K_2O 1.4%.

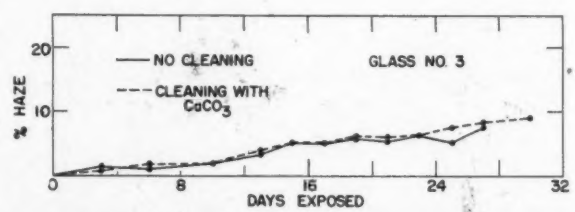

Fig. 16. Comparison of method of cleaning of outside of bottle (glass No. 3). Glass composition: SiO_2 71.0, R_2O_3 1.4, CaO 8.1, MgO 5.6, BaO 0.62, Na_2O 12.9, K_2O 0.35%.

(*Continued on page* 534)

New Owens-Illinois Technical Center Opens

● IN THE WESTERN SECTION of Toledo, Ohio, the Owens-Illinois Glass Company the other day opened its new Technical Center. This facility is said to be the most modern and complete glass engineering and research installation anywhere in the world.

The two-story center, covering a ground area of almost 130,000 square feet, brings together facilities which formerly were at five separate locations, making it possible for the first time for O-I's staff of over 500 scientists and engineers to carry through a research program from start to finish under one roof. In addition to its 50 laboratories, the center contains office and drafting room facilities and a pilot plant. This eliminates the former need for plant tests outside the laboratories and makes it possible for new products to go directly into full-scale factory production as soon as they are released by the Technical Center.

Highlighted by official dedication ceremonies on September 27, thousands of persons in the glass industry toured the installation during the preceding two weeks. Most came away impressed with the completeness of the facility and with a number of spectacular developments which were exhibited there.

Physically, the Center is the result of many years of planning and two years of actual construction work. The two-story office and laboratory section is constructed of yellow brick enclosing the first floor, with aluminum panels around the exterior of the second story. Window frames are of aluminum and consist of a combination of clear glass and light-diffusing glass block. The one exterior wall of the pilot-plant section is made of light-colored brick and metal panels with asbestos covering. The one-story pilot plant is at the rear of the office section and utilizes high-bay construction in the machine and furnace area.

The interior design features versatility, adaptability and attractiveness.

Light weight, movable partitions are used in the office area to permit changes in room sizes as current needs dictate, or to convert laboratories into office space and vice versa.

A minimum of partitions is used in the pilot plant. Its major sections include electrical, machine and pattern shops, research and development areas and a high-bay section for hot glass operations.

Since experimental and pilot-plant work is done at the Center for any of the thirty Owens-Illinois plants located all over the country, many different types of power sources have been made available at the new facility, so that conditions at any plant may be duplicated with little effort.

The basement of the building contains a cafeteria and recreation room for the employees. Outside the cafeteria is a 5,600-square-foot courtyard which has been paved and landscaped.

At a special preview of the Center, Oscar G. Burch, Owens-Illinois vice president in charge of research and engineering, stated that the goal of the Center was, briefly, to find new and improved glass products and better ways for making them.

"That comprehensive goal," he said, "includes far-reaching and vital studies which are of world-wide concern to glass scientists.

"One of our major objectives, for example," he pointed out, "is to determine what holds glass together. Once we've solved the mystery of the structure of glass, we hope to put that knowledge to work to make glass more versatile, adaptable and generally more serviceable to man."

Burch said that "while glass is invaluable to science in research on other problems, scientific research on glass is comparatively new."

The Technical Center was designed specifically for carrying out complete research programs consisting of five major phases:

(1) Pure research, in which the theory is developed.

(2) Applied research, in which the theory is tested

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Eighteen Papers Presented at Fall Glass Division Meeting

• The Glass Division came back to an old familiar sight to hold its Fall Meeting on September 15 and 16 at the Bedford Springs Hotel, Bedford, Penna. Registration was approximately 300, of whom about 30 were accompanied by their wives. Two distinguished guests from foreign countries were present, Dr. J. M. Stevels, Philips Research Laboratories, Eindhoven, Netherlands and Dr. W. J. R. Merren, director of research for Pilkington Bros. Ltd., England. A luncheon meeting of committee C-14 was held on Friday, September 16.

A very interesting program was arranged by the following committee: J. W. Michener, Owens-Corning Fiberglas Corp., Newark, Ohio; F. R. Bacon, Owens-Illinois Glass Company, Toledo, Ohio; Orson L. Anderson, Bell Telephone Laboratories, Murray Hill, New Jersey. The program was crowded with too many papers for the time allotted for presentation; however, credit should be given to everyone participating for an enjoyable meeting.

J. W. Michener was chairman of the afternoon sessions on Thursday. J. M. Stevels, Philips Research Laboratories, Eindhoven, Netherlands was the first speaker and honored guest. Dr. Stevels paper, "The Effect of X-ray Irradiation on the Structure of Quartz, Fused Silica and More Complicated Glasses, as Revealed by Modern Physical Methods" was a highly theoretical one related first, to a systematic survey of all the theoretical possible imperfections in the SiO_2 lattice (network). Three tools were employed to study these imperfections, namely: (1) The dielectric losses for medium frequencies at low temperatures (deformation losses). (2) The absorption spectra. (3) The paramagnetic resonance. Dielectric loss measurements is probably the most useful tool. This purely theoretical system was extended to describe the structure of glasses, in which imperfections are present in abundance. In general the deformation loss is low for glass, while for crystals there are sharp peaks. Data on natural quartz, synthetic quartz, smoky quartz and amethyst were compared. Synthetic quartz crystals prepared by Bell Laboratories indicated the peaks were related to impurities such as lithium, sodium and aluminum. Differences in the deformation loss of smoky quartz and natural quartz indicated that the former had possibly been irradiated by nature.

There are eight possible changes in the network of SiO_2 alone. Examples of these changes were given in terms of two-dimensional diagrams. It was shown that these tools gave useful information on the imperfections in quartz and fused silica that was applicable in a later paper to certain glasses.

The next paper, "Formation of Color Centers in Glasses Exposed to Gamma Radiation," N. J. Kreidl and J. R. Hensler, Bausch & Lomb Optical Co., Rochester, New York, was presented by Mr. Hensler.

Glasses exposed to gamma radiation develop a visible absorption similar to the F-band developed in alkali halide crystals. The function of cerium in preventing coloration of the glass was studied in detail in an ultraviolet transmitting phosphate base glass in which its characteristic absorption could be measured. It was found that when visible absorption was so prevented, radiation still caused a strong absorption in the ultraviolet which was associated with the presence of unpaired electrons in cerium. On this basis transition ions of similar electronic structure were introduced. It was found that iron, manganese, cobalt, nickel, vanadium, and copper, and, under certain conditions, some other elements, do suppress the formation of the visible absorption band formed in the base glass by radiation while forming more or less prominent bands in other spectral ranges. The colorless iron phosphate glass remained colorless under radiation and could be considered "protected." Conversely, with cobalt the new band which reached into the visible, was relatively intense and stable, suggesting its use to indicate radiation dosage.

The base glass definitely effects the fading characteristics of the element and germania glasses were found to be rather insensitive to irradiation.

The question was raised as to whether or not irradiation caused a change in density of the glass, the answer was that *no* change was found.

A. J. Cohen, Mellon Institute, Pittsburgh, Pennsylvania, presented the next paper, "Color Centers in Rather Pure Silica—Part III: Comparison of the Vitreous with a Crystalline State (a-quartz)."

The color center phenomena in Amersil (Homogenized Ultrasil) and Corning fused silica have been described earlier*. These results were compared to color centers produced in smoky and amethyst quartz both in the laboratory and in nature. Postulates which account for the similarity of these centers in vitreous and crystalline SiO_2 were also presented.

Impurities in amethyst have been known for many years and were believed to be synonymous with a Maltese-cross structure or twinning.

A comparison of the absorption spectra for samples irradiated for 1 hr., 295 hrs., 313 hrs. and up to 1000 hrs., indicated that the peak is still growing.

Synthetic quartz (Bell Laboratories) was doped with various impurities such as Al, Ge, Li, etc. in the range of 1-300 parts per million. Changes in the anisotropy of the color centers were noted.

"A Study of Glass Fracture with the Electron Microscope," by W. R. Prindle, Hazel-Atlas Glass Co., Wheeling, W. Va., was the subject of the next paper. Mr. Prindle presented some results of work conducted at M. I. T. in which the high magnification of the electron

*Part I delivered at 1954 Fall Meeting of Glass Division, Pittsburgh. Part II delivered at 57th Annual Meeting, 1955, Cincinnati.

microscope was adapted to a thorough study of glass fracture.

An attempt was made with the electron microscope to determine whether or not Griffith flaws existed in glass in the size and form suggested by many theorists. No evidence was observed for internal flaws, but many flaws and sites of potential stress concentration were observed on pre-fracture surfaces.

In the course of the study the characteristics of glass fracture surfaces were examined. The mirror portions of a fracture were found to be generally smooth and the rib patterns exhibited no fine structure. The nature of the mat regions was determined and related to the hackle structure. The details observed were found to be compatible with existing theories of fracture.

It was pointed out that observations of interior flaws offers considerable difficulties. Some interesting pictures were made on the micro-crystalline structure developed in gold ruby as well as certain fluoride opals. It was believed that they were similar to the so called "Wallner lines"—tailing out and finally disappearing in the glass itself.

R. E. Mould, Preston Laboratories, Butler, Penna., presented the next paper, "The Fracture Velocity of a Soda-Lime Glass, Pyrex and Fused Silica from Room Temperature to 600°C.".

The limiting velocity of propagation of a fracture was measured for a soda-lime glass, pyrex and fused silica over the temperature range 20°C. to 600°C. The measurements were made by determining electronically the time necessary for a fracture to travel between two platinum lines fused into the glass. For the soda-lime glass and pyrex the velocities at 20°C. were respectively 1500 and 1935 m. per second and decreased slightly with increasing temperature. For fused silica the velocity was 2102 m. per second at 20°C., and, within experimental error, was independent of temperature.

A resume of the work of previous investigators was given and it was concluded that there is a limiting velocity at which a fracture can propagate through glass, the fracture starts slowly and then accelerates and even though fractures have been carefully and accurately measured they are still poorly understood.

The next paper, "Relations between Refractive Index and Elastic Modulus of a Borosilicate Glass after Heat Treatment," S. Spinner, and A. Napolitano, National Bureau of Standards, Washington, D. C. This paper was presented by Mr. Spinner.

Several specimens of a borosilicate glass were subjected to a series of different annealing schedules and the refractive index and elastic modulus measured and compared after each heat treatment. The elastic moduli were determined by a dynamic (resonance) method and the refractive indices were measured on the Grauer Refractometer. A linear relationship was found to exist between these two properties as a result of these heat treatments. A similar (linear) relationship has been established between, refractive index and density by several investigators. This indicates that the same fictive temperature T (tau) scale can be used to characterize the condition of a glass with respect to three properties, index of refraction, density, and elastic modulus.

This careful research work tends to re-emphasize the importance of previous heat treatment on the room-temperature properties of glass.

Dr. C. H. Greene, State University of New York, College of Ceramics, Alfred, New York, presented the paper, "Some Observations on the Strength of Acid Polished Strips of Flat Glass".

Results were presented of preliminary work which tends to substantiate the concept that the strength of glass is *not* an intrinsic property, of the material, but rather a surface property. It is best expressed by a distribution function giving the average number of sources or flaws per unit of area which will cause failure when the tensile stress in the area reaches a given value.

Tests upon strips of sheet glass 3 in. wide and 10 in. between supports with a single loading knife edge yielded modulus of rupture values as high as 200,000 psi after the samples had been acid polished. It was not possible, however, to eliminate the effect of edge flaws completely. Samples of sheet glass, which had been preserved without contact except for the asbestos drawing rolls, exhibited strengths greater than 40,000 psi when the edge flaws were smoothed by acid polishing. Further experiments with a micro-flash unit for determining the point of origin of the breaks in these samples are contemplated.

In discussion of the paper it was suggested that changes in sample size might be advisable for a single loading knife edge type of test.

"Strength of Some Simple Glasses," written by T. J. Whalen and R. M. Witucki, Pennsylvania State University, University Park, Penna., was presented by T. J. Whalen.

Results were presented on the strength of some simple glasses of the type: B_2O_3; $2ZnO.Al_2O_3.5P_2O_5$; $.34Na_2O.SiO_2$ and $Na_2O.CaO.SiO_2$. It was noted that the B_2O_3 glasses took on a weight coating soon after forming which caused a marked decrease in strength. Coating the glass sample rods with motor oil produced a definite increase in strength.

The glasses used showed the following relation in strength value. The B_2O_3 glasses were the weakest, the phosphate glasses next, the sodium silicate glasses the next and the soda-lime-silica or commercial glasses the strongest.

The surface appearance was found to be highly important and any surface scum appeared to decrease the strength of the glass.

The next paper was "The Strength of Soda-Lime-Silica Glass Rods and Fibers after Acid Polishing," by J. W. Michener, Owens-Corning Fiberglas Corp., Newark, Ohio.

The results of strength measurements on 0.2 inch experimental and commercial soda-lime-silica glass rods were reported. The rods were produced under various conditions and received different after treatments. Rods which received an acid polishing treatment exhibited strengths in excess of 200,000 psi. Comparative data on fibers of 10×10^{-5} and 40×10^{-5} inch diameter showed the strength values to be about 375,000 psi.

Strength values of small glass rods, when comparably treated, show little difference from that of glass fibers and the difference in strengths are believed not to vary as much as has commonly been expected. This paper was an excellent conclusion to a series of papers that were devoted to a better understanding of the strength of glass.

At the annual banquet held at the Bedford Springs Hotel dining room, O. G. Burch, Trustee of the Glass Division and Vice President Owens-Illinois Glass Co., presented the Frank Forrest award and the S. B. Meyer Jr. Award. The former was won by Dr. Francis J. Norton, General Electric Laboratory for his paper "Helium Diffusion in Glass." The latter was given jointly to Dr. A. E. R. Westman and Joan Crowther, Ontario Research Foundation, for their paper, "Constitution of Soluble Phosphate Glasses."

Dr. W. C. Decker, President Corning Glass Works, gave an interesting address, "What Management Expects of Research." Dr. Becker pointed out that management should assume a *friendly, fair* and *firm* attitude toward research and research personnel. At the same time, in order for research to succeed, they should have creative imagination, inspired leadership and have considerable liberty and freedom of activity in their work.

The glass industry has grown to an industry whose gross sales in 1954 amounted to a billion, six hundred million dollars. At Corning Glass Works in the same year, 65% of the sales had been created largely through previous efforts of research.

Dr. Decker very appropriately pointed out the need of glasses of improved strength especially higher strength per unit section. Other objectives were listed as better melting and fabrication.

His address was concluded by showing a recent product of glass research which will aid greatly in the successful production of color television. The sheet contained 400,000 small holes all aligned perfectly to a semi-focal point. It represented the adaption of photosensitive glass, chemical machining and a Photo-Ceram Glass, all products of research. The address was particularly inspiring.

Larry Burwinkel, Jr., Pennsylvania Glass Sand Corporation, awarded the golf prizes. Fifty-three golfers took advantage of the opportunity to play golf Thursday morning before the technical session started. Low gross of 89 was tied by Messrs. Hopkins, Hummel and Henry. Many other prizes were awarded on the basis of handicaps.

The ladies program was ably handled by the following committee: Mrs. D. Owen Evans, chairman; Mrs. L. G. Burwinkel, Jr., Mrs. J. E. Frazier, Mrs. C. Gum, Mrs. L. A. Holmes, Mrs. J. C. Keaney, Mrs. C. E. Leberknight, Mrs T. Lenchner, Mrs. V. Remington, Mrs. A. C. Siefert and Mrs. R. L. Wheaton.

The ladies were amply entertained by "surrey rides", luncheons, bridge, canasta, etc.

In order to discuss the general problems of the strength of glass in more detail the conventional panel technique was used. This portion of the program was planned by Dr. S. D. Stookey, as chairman of the Symposium Committee. The membership of the panel was as follows: Moderator: L. G. Ghering, Preston Laboratories, Butler, Pa.; Panel Members: O. L. Anderson, Bell Telephone Laboratories, Murray Hill, New Jersey; W. H. Otto, Owens-Corning Fiberglas Corp., Newark, Ohio; E. B. Shand, Corning Glass Works, Corning, New York; J. M. Teague, Owens-Illinois, Toledo, Ohio; L. Orr, Pittsburgh Plate Glass Co., Creighton, Pa.

Dr. Anderson in discussing the pure science aspects of strength in glass pointed out that the ultimate failure is due to some types of flaw distribution and it is not necessary that the flaws be visible with the aid of the electron microscope. It is possible that flaws are caused by a sudden or catastrophic breaking of bonds that cause an almost instantaneous formation of flaws. The absence of the evidence of flaws does not mean, therefore, that flaws do not assume an important part in fracture or ultimate strength of glass.

Mr. Otto considered strength of glass based on experiences with glass fibers. He believes that differences in strength between fibers and massive glass is not anomalous. The variations may be due to the method of drawing, thermal history and the variable manner of testing. For example, drawing tubes is quite different from high temperature attenuation practiced in the formation of fibers. Comparable surfaces in fibers are likely to be more uniform than in massive glass. Because of the sensitive variations affecting strength it is possible to make strengths go up and down almost at will.

Mr. Shand discussed the important influence of design on the strength of glass. Design is known to be very important in attaining strength in gage glasses, windows, piping, viewing windows, TV tubes, and glass to metal seals, etc. The distribution of stresses and stress analysis, therefore, assume considerable influence as an aid to proper design. The vital factor is what service performance the product will render.

Mr. Teague considered the importance of strength of bottles and containers. The actual strength of bulk glass is the important consideration and the type of testing is largely dependent upon the use to which the product is to be put. Generally speaking, the internal-hydrostatic pressure test is probably the most important and the one generally used. The practical limit of strength in such products is in the range of 5,000-10,000 psi.

Mr. Orr pointed out that laboratory testing of flat glass usually involves study of the strength of edges while service performance in the field usually involves surfaces or areas of considerable magnitude. The use of a 9 in. diameter disc has been successful as a test sample because of the uniformity of results. The appearance of the fracture, especially at the origin, and the use of postmortem studies was highly recommended. The analysis of fracture can be as highly important as the testing itself, particularly the radius of the smooth or mirrored areas at the source of fracture. Stresses for flat glass were said to range from 2,500-5,000 psi.

The comments of the panel raised many questions. Some important thoughts were that fibers are not annealed but in the process of high temperature attenuation the fiber is more or less compacted into a denser glass. The compaction is said to increase as the temperature of heat treatment increases, for example the compaction is greater from 600°C than from 300°C.

The improved strength of tempered glass may be influenced by the "leveling off" or reduction of flaws on the surface by fireproofing of the surface defects.

The possibility of creating a glass with super strength was suggested by the use of controlled heterogeneity of the glass. It is possible that such a glass might possess flaws but once formed the flaws or cracks would *not* grow or propagate.

The panel discussion was most popular and the response to discussion was quite spontaneous.

A. C. Siefert, Owens-Corning Fiberglas Corp., was

chairman of the Friday afternoon session. An informal report on the Gordon Research Conference on Glass Structure was given by F. C. Flint. This conference, which was the first Gordon Conference devoted to glass, was held at the Kimball Union Academy, Meriden, Connecticut, August 15-19. The Gordon Conferences are under the direction of the American Association for the Advancement of Science (AAAS) and this initial conference was held at their request under the guidance of the Glass Division, with the understanding that future conferences will be controlled in the same manner. F. C. Flint and O. L. Anderson acted as chairman and vice-chairman respectively.

These conferences are organized in order that men of mutual interest may discuss in an informal manner fundamental problems related to their respective industry. There were about sixty attending the conference and many men representing related fields such as plastics, phosphates, etc., were in attendance to present views that were closely related to glass. The conference was quite successful and it is highly desirable that the Glass Division maintain interest and control of the programs. O. L. Anderson and Harrison Davies have been elected chairman and vice chairman for the coming year.

N. J. Kreidl announced that the Fourth International Congress on Glass will be held at Paris, France, July 2-7. The Congress will be conducted somewhat like the Gordon Research Conference and anyone interested in contributing a paper is urged to write H. R. Lillie, Corning Glass Works, Corning New York, as to the type and subject matter of the paper. This request is made in order that a balanced program of interesting papers may be scheduled.

The first paper of the afternoon session was, "The Dielectric Losses in Quartz, Fused Silica, and Glass," by J. M. Stevels, Philips Research Laboratories, Eindhoven, Netherlands.

The dielectric losses of glasses may be analysed as caused by three different effects: the vibration—, the migration—and the deformation losses. These were discussed as a function of frequency, temperature and composition. A few examples were given showing how this knowledge may be used in order to tackle the problem of the structure of glass.

The deformation losses are an especially useful tool to study the imperfections in both virgin and x-ray irradiated quartz crystals and fused silica. Other examples included simple silicates of Li, Na, K, Rb, Cs as well as some complicated silicates involving various concentrations of alkalies and alkaline earths.

Deformation losses were cited especially as being useful in studying and permitting speculation as to structural changes in glasses.

The next paper was, "The Brookfield Synchroelectric Viscometer for Measurement of Glass Viscosity," by G. R. Machlan, Owens-Corning Fiberglas Corp., Newark, Ohio.

The Brookfield Synchroelectric Viscometer has been used with considerable success by Owens-Corning Fiberglas Corp. for several years for process and quality control work. The viscometer is accurate, easy to operate, easy to maintain and does not have to be rebuilt for each operation. It is readily mounted over a platinum wound furnace and a stainless steel spindle is submerged into a crucible containing the glass. The instrument was standardized with the rotating crucible type of instrument, used by Lillie and others and *excellent* checks were obtained. The useful range of the instrument is from approximately 1-48,000 poises. It has been used with glasses up to a temperature of 2750°F.

It is believed that the instrument could be mounted in a forehearth of a glass tank for continuous operation. This instrument apparently offers a rather easy means of measuring an important property of glass.

The next paper was, "The Emissivity of Transparent Materials," by R. Gardon, Mellon Institute, Pittsburgh, Penna. Fundamental data on the emmisivity of transparent materials like glass have shown this property to be a bulk phenomena and not a surface phenomena alone. The index of refraction of the glass is highly important in determining rates of emission.

Emissivity values of glass sheets at various temperatures and different glass thicknesses were shown. Corrected values are expected to be an aid in providing more accurate temperature measurements of molten glass surfaces. The improved techniques are expected to be a help in the measurement of the heat flow, annealing and heat treatment and will ultimately be of considerable practical importance.

The next paper was, "Phase Separations in Glasses Containing Sulfates," by G. E. Rindone, Pennsylvania State University, University Park, Penna.

An investigation was made of the reactions taking place when two molten glasses of different compositions are poured together in a furnace. Observations were made in the furnace using a telescope and carbon arc lamps for illumination.

Of particular interest was the behavior of alkali barium silicate glasses containing small amounts of sulfates. When a glass of this type containing Na_2O is poured together with a similar glass containing K_2O a phase separation occurs accompanied by gas evolution. Upon cooling the mixture in the crucible, a crystalline phase forms in one layer leaving a sharp boundary line between the two layers. The crystalline phase was found to contain practically all of the sulfate. The phase separation first comes out as liquid droplets.

On the basis of these experiments, an explanation is offered for the cause of "delayed" seeds which frequently occur in commercial glasses of high barium content.

The next paper, "Anomalous Properties of Some Titania-Containing Glasses," by Bh. V. Janakirama-Rao and W. E. Hauth, Jr., International Resistance Co., was presented by Mr. Hauth.

"Density, softening temperature, chemical durability, dielectric constant, coefficient of expansion and refractive index of 114 glasses in the system $SiO_2.K_2O.TiO_2$ were studied. The procedure was: weight per cent substitution of TiO_2 for SiO_2 up to 55 per cent TiO_2, in glasses covering the whole area of glass formation in the system.

TiO_2 was found to have a unique pattern of, softening temperature *vs.* concentration, curves in this system. Increasing concentration of TiO_2 at first increased the viscosity and then decreased it. The peaks of the softening temperature curves correspond to the transition in the coefficient of expansion curves of the same glasses.

TiO_2 was found to have a *positive "factor"* for coeffi-

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Improved Glass-Fiber Paper

● RESEARCH AT the National Bureau of Standards has succeeded in producing an all-glass paper eight times as strong as that first made in 1951. Because of its greater strength, this paper should prove much more convenient for those uses—such as gas masks, chemical filters, and electrical equipment—where the unique properties of the all-glass paper have already made it particularly valuable.

The higher strength is achieved by control of the acidity and temperature of the glass fiber suspension and by minor changes in the mechanical handling of the fibers in the paper mill. Details of the improved process were worked out in the Bureau's paper laboratory as part of a project sponsored by the Naval Research Laboratory.

Although glass fibers have been widely used for some time in textiles, such as glass curtains and filter cloths, and in plastic laminates, their use in making all-glass papers is relatively new. About three years ago, the Bureau, in cooperation with NRL, produced the first machine-made paper composed entirely of glass fibers without additives or binders. This paper, which resembles soft blotting paper, was found to have a number of important applications. Tests showed it to be many times more effective as an air filter than commercial filters then on the market. In gas-mask tests in a smoke-filled room, only one smoke particle in 100,000 passed through the glass-paper filter. Another advantage of all-glass paper is its high resistance to heat, moisture, chemicals, and micro-organisms. This, in combination with excellent electrical characteristics, makes it valuable as an insulator and dielectric for special applications.

Several paper mills are now producing the all-glass paper for military and civilian uses. The product has appeared on the market in mine respirators and gas masks and as filter disks for laboratory crucibles. It is being studied for possible use as a filter of hot or corrosive fluids, as an air filter in air conditioners, as a saturating or laminating base for plastics, and as an electrical insulator in coil windings, condenser and transformer cores, and battery separators. Other possible applications include heat insulation where a thin material is required, sterilizable papers for medicine and surgery, and antitarnish and anticorrosion papers.

However, for all these uses, the low tensile strength of the all-glass paper—originally 30 to 40 lb/in.^{2}—has been a disadvantage, requiring extra care in production, storage, and handling. The improvements made in the process by NBS increase the tensile strength to more than 300 lb/in.^{2} and should thus make the glass-fiber paper considerably more practical for commercial manufacture and use.

Because the properties of glass fibers are so different from those of the cellulose fibers ordinarily used in paper making, considerable change has been necessary in applying the usual papermaking techniques to the manufacture of glass-fiber. For example, in the manufacture of ordinary paper, vegetable fibers are processed with water in a "beater", which bruises the fibers and forms minute fibrillae. Mechanical entanglement of these fibrillae aids in bonding the fibers together. In addition, prolonged beating is thought to increase the adsorption of water on the fibers, which enhances fiber-to-fiber bonding when the fibers of the paper are dried in close contact.

With glass fibers, on the other hand, no fibrillation takes place, and no significant hydration ordinarily occurs. Because bruising breaks the fibers and tends to weaken the paper, the beater is adjusted to eliminate most of the pressure on the fibers and is used merely for suspension and circulation of the fibers.

In the glass paper making process as improved at the Bureau, beating is conducted at a temperature of 85°F. and the pH of the glass-water mixture is adjusted to 3.5 or less by adding sulfuric acid. Under these conditions, the fiber bundles open up and are dispersed more quickly, less fiber breakage occurs and the resultant paper is stronger.

Mechanical changes have been made in the equipment to eliminate strings or lumps in the finished paper. Because glass fibers in the stock flow system of a paper mill tend to accumulate on any projection or rough place, sharp angles were eliminated from the piping. A horizontal stock chest with agitators moving in a vertical plane was also installed so that the fibers would fall back into the liquid instead of accumulating in strings as they do on horizontal agitators.

When the fiber suspension was brought to a pH of 3.0 as it entered the jordan, it was found possible to pass it through the jordan refiner of the paper mill without damage to the fibers, a step that had hitherto been impossible. Treatment in the jordan also helped to break down strings and knots, resulting in a much improved formation in the finish sheet.

Previously it was necessary to maintain a fairly high moisture content in the all-glass paper in order to carry it onto the reel of the paper mill, for the glass paper has a higher tensile strength when wet than when dry. The additional strength was sufficient to eliminate breakage between the dryers and the reel. However, glass papers made by the Bureau's improved process have enough strength so that they can be dried to the same extent as cellulose papers and still be carried onto the reel without breaking.

Photomicrographs made at the Bureau show the effect of a lower (more acid) pH in binding the fibers together to give higher strength. Ordinarily acid reacts so slowly with glass as to have negligible effect. However, the very fine glass fibers expose a tremendous surface to the acid, which starts to dissolve the soda and lime in the glass, leaving on its surface a thin gelatinous layer, rich in silica. When the water drains from the

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Inventions and Inventors

Feeding and Forming

Method of Making Glass to Metal Seals. Fig. 1. Patent No. 2,701,909. Filed October 11, 1950. Issued February 15, 1955. One sheet of drawings. Assigned to General Electric Company by Anatole M. Gurewitsch and Herbert C. Pollock.

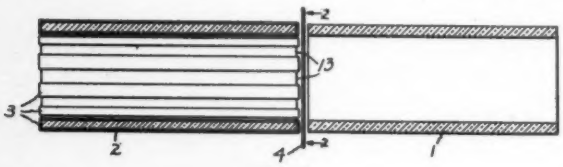

Fig. 1

A new and simple method of making fluid-tight glass to metal seals is presented. There is shown in Fig. 1 an untreated or plain vitreous or ceramic part 1 which is to be sealed to part 2, the latter having thereon a number of metal strips 3, the thickness of which is about one mil. The strips may be laid on the ceramic or vitreous material in the form of foil and baked or fired onto the surface. The two parts 1 and 2 are juxtaposed and maintained in intimate contact with a heater strip or ribbon 4 which is positioned between them. The purpose of the heater ribbon 4 is to heat parts 1 and 2 to the point of fusion of the vitreous or ceramic material at which part 1 fuses and forms a seal with ribbon 4. The edge portions 13 of part 2 between the strips 3, as well as the strips themselves, also seal with ribbon 4. In order to prevent short circuiting strips 3 with one another in those cases where strips 3 are destined to carry different electric potentials, ribbon 4 is preferably made in a zig-zag shape. It is preferable to slowly preheat the entire assembled parts or assembly in an oven or furnace to a point within fifty or one-hundred degrees of the fusion point of the ceramic or vitreous material. Then while still in the oven or furnace, electric current is passed through the resistance heater ribbon 4 and the parts raised thereby to the sealing temperature. After the sealed structures have cooled, the heater strip may be removed from the exterior and interior of the structure, if desired, leaving a smooth joint with no short circuiting interconnections of ribbon 4 between strips 3. The extremely localized fusion of the material using this process tends toward a smoother seal than is possible using other methods.

The patent contains two claims and the following references were cited: 495,240, Benjamin, Apr. 11, 1893; 2,106,143, Williams, Jan. 18, 1938; 2,125,316, Ronci, Aug. 2, 1938; 2,386,820, Spencer, Oct. 16, 1945; 2,388,242, Arndt, Nov. 6, 1945; 2,445,063, Guyer, July 13, 1948; 2,526,703, Smith, Oct. 24, 1950; 108,056, Australia, July 21, 1937; and 549,277, Great Britain, Nov. 13, 1942.

Apparatus for Producing Glassware. Fig. 2. Patent No. 2,712,716. Filed August 27, 1954. Issued July 12, 1955. One sheet of drawings. Charles W. Carlson.

This invention relates to a novel apparatus for producing decorative glass articles such as goblets and other stemware and more particularly to an apparatus whereby glass stemware and similar decorative articles may be formed with internal bubbles or teardrops of predetermined size, form and disposition. A block 13 contains a vertical cylindrical cavity or opening 14 there through and is movable horizontally to underlie the stem cavity 12 axially as shown in Fig. 2 and is also movable to a position where its upper surface is clear of the stem mold parts 10 and 11. A pair of coaxial plungers 16 and 17 normally underlie the cavity 14 of block 13 and cooperate to provide a bottom for such cavity during the filling thereof with a charge of molten glass. After block 13 with plungers 16 and 17 is moved to a position directly underlying stem mold 10, 11, inner plunger 17 is moved upwardly where the upper end of its main body portion meets the upper end of the larger internal bore portion of outer plunger 16 and further upward movement of the inner plunger 17 carried with it outer plunger 16 which ejects molten glass from cavity 14 upwardly into stem mold 10, 11. This brings the plunger parts to the position illustrated in Fig. 2 and controlled introduction of blowing air upwardly through the bore 19 of inner plunger 17 forms the hollow bubble designated 20. After the pressed stem and its attached bowl are removed from the apparatus by separation of the stem mold parts 10 and 11, a foot is applied to the bottom of the pressed stem in the usual manner, such application serving automatically to close off the bottom of the bubble 20.

The patent contains four claims and the following references were cited: 704,760, Schaub, July 15, 1902; and 2,333,745, Schwartz, Nov. 9, 1943.

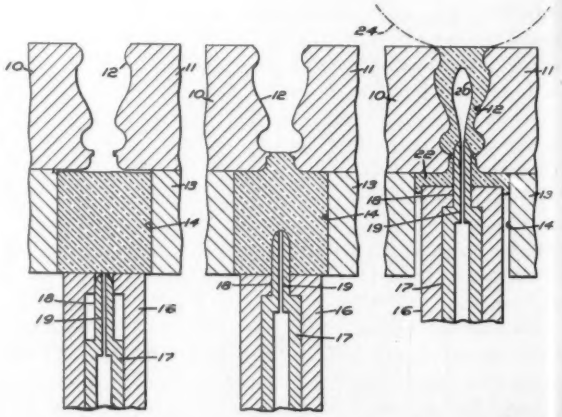

Fig. 2

Furnaces

Automatic Charging of Glass Furnace. Fig. 3. Patent No. 2,711,837. Filed October 26, 1946. Issued June 28, 1955. One sheet of drawings. Georges Henry and Edgard Brichard.

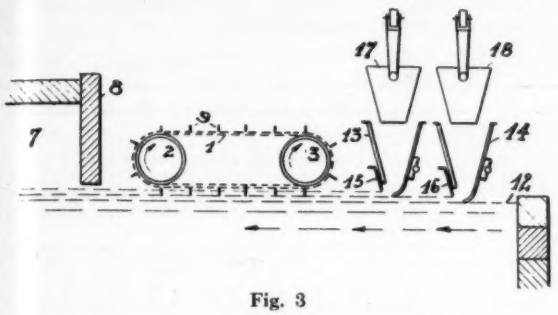

Fig. 3

This invention relates to a method for continuously introducing a glass composition into glass furnaces in a manner for improving the technical and economical conditions of glass melting. It has been found that the melting of the glass is accelerated and that the product obtained is more homogeneous when the thickness of the layers of composition put into the oven or hearth is reduced while their horizontal stretch over the surface of molten glass is correspondingly increased. In Fig. 3 is shown an endless belt 1 provided with a series of blades made of heat-resisting metal and hinged to one another. The belt 1 covers a certain area of the surface of the molten glass occupying the pot or furnace 7 used for melting. This part of the pot or furnace is is preferably a width very near that of the pot itself so as to increase the area of the sheet of composition put into the oven. To the blades of the belt 1 are secured at intervals smaller blades 9, forming feeding means and projecting towards the outside of the belt. The metal belt 1 drives, as it moves along, the superposed strata or layers of composition (from hoppers 13 and 14) by small blades 9. The layers of glass composition are urged towards the oven beyond the roller 2 under the action of the continuous admission of fresh composition material. The movement, transmitted to the underlying glass film surface which is slightly cooled through radiation at the location 12 and also due to contact with the supplied cool glass composition, starts the latter to move through a tractional stress extending up to the points lying underneath the distributors 13 and 14 which place on the glass film surface suitable relatively thin layers of material under the most convenient conditions. The drive is not limited to the zone lying immediately underneath the belt but affects the whole surface of the glass rearwardly of the zone and extending up to the rear wall 12, of the oven extension part, where the glass surface is not in contact with the supplied glass composition and is allowed to cool down at its surface to form a fine glass film thereon, which has a predetermined relatively large cohesion.

The patent contains four claims and the following references were cited: 1,623,057, Kingsley, Apr. 5, 1927; 1,916,262, Good, July 4, 1933; 2,261,022, Fox et al., Oct. 28, 1941; 2,281,050, Redshaw, Apr. 28, 1942; and 2,284,398, Kutchka, May 26, 1942.

Glass Compositions

Improved Methods of Fining Glass. Patent No. 2,702,749. Filed March 16, 1951. Issued February 22, 1955. No drawings. Assigned to Bausch & Lomb Optical Company by Harold C. Hafner, Gordon F. Brewster and Robert A. Weidel.

Specifications are given for an improved method for fining glass. It has been found that the removal of bubbles can be considerably improved when certain aids are replaced by adding to the melt or the batch from which it is made, a small amount, as little as one one-thousandth of one per cent, of an agent which prevents wetting at the glass-platinum interface and allows the gas bubbles to collect into large bubbles and rise or escape at the interface. Iodine and bromine have been found to prevent molten glass from wetting the surface of a platinum crucible. By the substitution for the ordinary fining aids of very small quantities of potassium iodide or potassium bromide, a melt is obtained which after fining has about one tenth of the quantity of bubbles usually counted in this type of glass when melted in platinum. When potassium iodide is used, the effective proportion is found to be one one-hundreth of one per cent (0.01%) by weight. The same result is obtained by from one tenth to one per cent (0.1-1%) by weight of potassium bromide. Other inorganic compounds which release iodine or bromine on heating, act in the same manner.

Some examples of glasses used are as follows:

Example	9	10	11	12
BaO	34.39	34.99	36.69	36.99
SiO_2	32.1	33.6	35.3	37.1
B_2O_3	6.9	7.2	7.6	7.6
Al_2O_3	0.5	0.5	0.5	0.6
ZnO	1.2	1.3	1.3	1.3
La_2O_3	8.1	8.4	8.9	8.9
CdO	3.2	3.3	3.5	3.5
Li_2O	3.6	3.8	4.0	4.0
Ta_2O_5	10.0	....	....	....
Cb_2O_5	....	6.9	....	....
TiO_2	....	....	2.2	....
KI	0.01	0.01	0.01	0.01

Example	9a	10a	11a	12a
BaO	34.4	35.0	36.7	37.0
SiO_2	32.0	33.5	35.2	37.0
B_2O_3	6.9	7.2	7.6	7.6
Al_2O_3	0.5	0.5	0.5	0.6
ZnO	1.2	1.3	1.3	1.3
La_2O_3	8.1	8.4	8.9	8.9
CdO	3.2	3.3	3.5	3.5
SrO	3.6	3.8	4.0	4.0
Ta_2O_5	10.0	....	....	....
Cb_2O_5	....	6.9	....	....
TiO_2	....	....	2.2	....
KBr	0.1	0.1	0.1	0.1

The patent contains 20 claims and the following references were cited: 1,572,625, Taylor, Feb. 9, 1926; 2,009,763, Dalton, July 30, 1935; 2,009,764, Dalton, July 30, 1935; 2,359,789, Pincus, Oct. 10, 1944; 2,397,195, Mook et al., Mar. 26, 1946; 2,407,874, Fraser, Sept. 17, 1946; 2,409,412, Armistead, Oct. 15, 1946; 2,433,882, Armistead, Jan. 6, 1948; and Ser. No. 395,364, Berger et al. (A.P.C.) published May 11, 1943.

System	Limiting Ratios	Effect of Increasing Ratio Above Maximum	Limits of Third Component
PbO-GeO_2-La_2O_3	0 to 2.6	Causes devitrification in batches larger than 5 g.	0 to 13%
PbO-GeO_2-Al_2O_3	0 to 4.65	Same as above (Improved melting technique may extend ratio to 5.00).	0 to 11.5%
PbO-GeO_2-ZrO_2	0 to 4.4	Same as above (Improved melting technique may extend ratio slightly).	0 to 3%
PbO-GeO_2-Al_2O_3-La_2O_3	0 to 4.45	Same as above	Combined 0 to 10%

System	Effect of Surpassing This Limit		Effects of Third Component
	At Low Ratios	At High Ratios	
PbO-GeO_2-La_2O_3	Causes devitrification.	Causes devitrification.	Very little effect, if any. Possible decolorization. More resistance to abrasion and chemical attack.
PbO-GeO_2-Al_2O_3	Increases difficulty of fusion.	— do —	Permits increasing ratio. More resistance to abrasion and chemical attack.
PbO-GeO_2-ZrO_2	— do —	— do —	Same as in Al_2O_3 system with a possible impairment of transmission. More resistance to abrasion and chemical attack.
PbO-GeO_2-Al_2O_3-La_2O_3	— do —	— do —	Same as in Al_2O_3 system.

Glasses. Patent No. 2,701,208. Filed May 10, 1954. Issued February 1, 1955. One sheet of drawings (none reproduced). Assigned to The Ohio State University Research Foundation by Henry H. Blau.

A method of making glasses which are especially useful for transmission of rays of relatively long wave lengths is given. The glasses consist of lead oxide, germania, and various stabilizing components such as ZrO_2, Al_2O_3, and La_2O_3. The limits of the glass-forming field in the various systems are established by the ratio of PbO/GeO_2. The characteristics of the useful glasses are shown in the table above.

The patent contains ten claims and the following references were cited: 2,330,324, Adams, Sept. 28, 1943; 2,386,685, Hood, Oct. 9, 1945; and 2,663,658, Schurecht, Dec. 22, 1953.

Method of Coloring Glass and Resulting Article. Patent No. 2,701,215. Filed May 29, 1953. Issued February 1, 1955. No drawings. Assigned to Corning Glass Works by William H. Kroeck.

This invention relates to the treatment of glass to produce a coloration in its surface with copper, which procedure is commonly known as copper-staining. It has been discovered that the migration of copper into the glass can be enhanced. That copper-stained glass of uniform color having the indicated spectral characteristics and free of haziness can be produced at temperatures low enough to avoid distortion by initially heating the glass while in contact with a copper-staining composition, in an atmosphere containing a substantial amount of SO_2, preferably an atmosphere resulting from controllably burning sulfur in air, to develop a yellow color therein and thereafter heating the glass in a reducing atmosphere desirably substantially free of SO_2 until the color due to copper in the glass is red. Staining compositions suitable for the practice of this invention comprise generally one or more copper components, such as CuO, Cu_2O, CuS, Cu_2S, $CuSO_4$ or Cu_2Cl_2, the equivalent Cu content usually amounting to about 40 per cent or more by weight of the total solids of the composition, the balance of the solids comprising an inert material or materials such as clay, ocher, or $BaCO_3$. These solids are dispersed or suspended in a vehicle such as lavender oil or other essential oil, turpentine, or water to form a paste or liquid which is applied to the glass as by brushing, spraying, or dipping.

The patent contains 22 claims and the following references were cited: 402,090, Leighton, Apr. 23, 1889; 1,947,781, Kreidl, Feb. 20, 1934; 2,428,600, Williams, Oct. 7, 1947; 2,486,566, Kreidl, Nov. 1, 1949; 2,498,003, Peterson, Feb. 21, 1950; and 2,662,037, Levi, Dec. 8, 1953.

Glass and Wool Fiber

Rotary Wheel for Linearly Feeding Multifilament Strands. Fig. 4. Patent No. 2,701,936. Filed February 3, 1953. Issued February 15, 1955. Two sheets of drawings. Assigned to Owens-Corning Fiberglas Corporation by Warren W. Drummond.

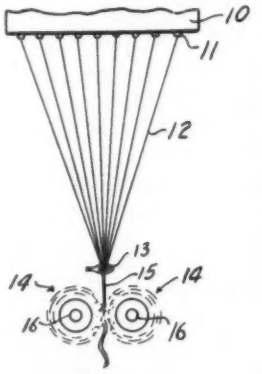

Fig. 4

This invention relates to coacting rotary wheels employed for the purpose of linearly feeding multifilament strands at extremely high speeds and more particularly to improvements in the construction of such wheels. Pulling rollers embodying the invention are well adapted for the purpose of attenuating glass fiber strands. A simplified showing of apparatus for performing this process appears in Fig. 4 in which a glass tank 10 for maintaining a supply of molten glass is provided with a plurality of nipples 11, each of which is pierced by a small orifice through which a stream of molten glass flows. The streams of molten glass flowing through the nipples 11 are formed into fibers 12 by being gathered together as by an eye 13 and fed between peripheries by a pair of high speed pulling rollers 14 to form a strand 15. The wheel 14

may be made from any one of numerous materials. It may be molded from reinforced resinous material, machined or cast from lightweight metal as, for example, aluminum. It is necessary only that it be made from material which has considerable tensile strength and rigidity so as not to be distorted greatly by the very great centrifugal force acting upon the radially large portions of the wheel during their high speed rotation. The periphery of each of the pulling wheels 14 is formed with generally sinusoidal scallops thus providing spaced projections and intermediate valleys.

The patent contains seven claims and the following references were cited: 2,030,252, Hale et al., Feb. 11, 1936; 2,259,202, Cooper, Oct. 14, 1941; and 2,419,320, Lohrke, Apr. 22, 1947.

Sheet and Plate Glass

Glassware Polishing Machine. Patent No. 2,700,255. Filed February 10, 1951. Issued January 25, 1955. Two sheets of drawings (none reproduced). William A. Meier.

This invention relates to apparatus for polishing gray cut surfaces in the ornamental designs of glass articles by means of a compound and a brush. The article is supported by a chuck which is rotatably mounted within a container. A plurality of brushes are mounted on rotary shafts within the container and are adjustable so that they will engage the rotary glass article and particularly the gray cut surface of the ornamental design. Each brush is adjustable so that it will engage a portion of the article and, if it is necessary, to polish the entire surface of the article. The brushes can be overlapped and thus cover the whole of the surface of the article at one time. If the design is small, all of the brushes may be set to cover it and thus polish the ware in a shorter length of time. The container holds the polishing compound which is preferably in the form of a liquid with the rouge in suspension and having the character of a mud. The level of the polishing compound may be such that it will be engaged by the brushes when they are in brushing engagement with the article, but when they are retracted from engaging the article they are lifted out of the polishing compound. Some articles may be sufficiently large in diameter so that their surface rotates in contact with the polishing compounds and thereby aids in carrying it around when being engaged by the brush or brushes.

The patent contains 6 claims and 21 references were cited.

Apparatus for Bending Sheets of Glass or Like Materials. Fig. 5. Patent No. 2,702,445. Filed April 20, 1951. Issued February 22, 1955. Three sheets of drawings. Assigned to Libbey-Owens-Ford Glass Company by Joseph E. Jendrisak.

This invention has to do with an improved apparatus by which flat sheets of glass of relatively large dimensions can be more readily and satisfactorily bent to predetermined curvatures. A bending appartus is shown in Feg. 5 of modified construction in which the flexible supporting tapes are arranged to support the sheet or sheets of glass while one end remains substantially stationary and the opposite end is moved angularly downward as the glass becomes softened and the effective spans of the tapes are lengthened. The apparatus 67 comprises a mold 68, having a generally rigid frame, which includes side walls 69 and end walls 70 and 71. The side walls 69 are fixedly secured to the end walls 70 and 71 along their vertical, abutting edges by welding or like methods. A base 72, formed by angle iron sections, is welded to and along the lower margins of the side and end walls to reinforce their assembly. When the glass becomes heated to its bending temperature, the handle 87 of the shaft 86 is engaged and the pawl 37 is released from the ratchet wheel 36 and swung therefrom by its weighted end 41. By mechanically or manually turning the shaft 86, additional lengths of tape will be served out or unwound from the reels 85 and carried upwardly over rollers 31 into the effective spans or flights 83. Since one end of the glass is located against the stops 88, it will literally pivot on these stops and effect a settling action in a downwardly swinging manner which is influenced by the angularly downward motion of the body of the glass as the additional tape is unwound. By controlling the gradual unwinding of the tapes 80 from one end only of the mold, the softened glass will tend to settle more readily into the more sharply curved portions of the shaping surfaces.

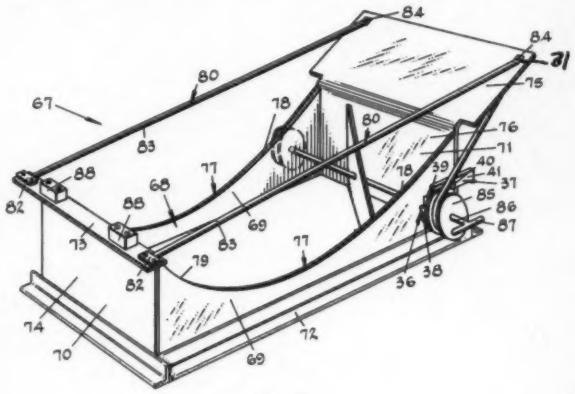

Fig. 5

The patent contains ten claims and the following references were cited: 760,959, Connington, May 24, 1904; 833,436, Borland et al., Oct. 16, 1906; 1,999,558, Black, Apr. 30, 1935; and 253,716 Germany, Mar. 27, 1912.

Tube and Cane Machines

Coating Composition for Electronic Tubes. Patent No. 2,702,250. Filed February 16, 1951. Issued February 15, 1955. No drawings. Assigned to The AP Parts Corporation by John C. Miller.

The present invention embraces the provision of a coating admixture or composition which may be satisfactorily used in flowable liquid form in a manner which facilitates the attainment of a smooth homogeneous coating of substantially uniform density and of a character which increases the efficiency of tube operation. Triethyl cellulose has been found to function in the dispersion as a satisfactory temporary binder to spread the graphite coating on electronic tubes. This material, after the tube is coated may be readily volatilized and driven off by

(*Continued on page* 542)

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Research Digest

Some Glass Problems in Modern Electronic Valve Making

During the past twenty years, the demand for lighter and more compact radio, and for increasingly complicated electronic equipment, has led naturally to a continuous desire on the part of manufacturers to produce smaller and smaller electronic valves. The trend in this direction has led to various improvements in the structure and design of valves. G. D. Redstow in the February News and Reviews section of the Journal of the Society of Glass Technology discusses some of the problems involved in modern miniature valve making. The principal glass-working operations in making a miniature valve are stem-making, sealing in and sealing-off (or "tipping-off"). The glass problems involved in these operations generally make themselves felt in the factory's economy at the sealing-in stage, where cracking of a single component means the loss of a mount worth a considerable sum. From a technical point of view, however, much depends on the quality of the button stems.

To make a miniature stem, a lead-glass ring is set over lead-wires held vertically in a die; the glass ring is then heated strongly by gas-oxygen flames, until melted when it is pressed to shape. As freshly-formed glass-to-metal seals are likely to leak it is essential to remelt the button, to give the glass every chance to react with the lead-wire surface. The remelted button is pressed again to its final shape, then is tempered by jets of cold air. The tempering helps the button resist the thermal shock of the sealing-in process. If the tempering is insufficient, then the tension stresses set up by the heating process of sealing-in exceed the surface compression and fracture the stem. If, on the other hand, the tempering is too severe, the stems tend to crack spontaneously. Great care is taken to avoid small cracks in the surface of the stem because if these are present, they can cause direct failure of the valve stem during its life. Small surface cracks are protected from the thermal shock of sealing-in by the tempering of the stem. It is only after sealing-in has released the tempering stresses that these small cracks can originate fractures. Avoidance of these small cracks is therefore, most important.

The mount is sealed into a bulb to which an exhaust tube has already been attached. After placing the mount and bulb on the sealing head, inert gas is passed in through the exhaust tube to limit the oxidation of parts of the assembly during heating. Soft flames then pre-heat the rim of the bulb and this is followed by the application of pin-point gas-oxygen burners which melt the rim of the bulb onto the rim of the stem. (It is this process which causes the large, temporary-radial-tension stresses in the stem and which can crack imperfectly-tempered stems.) The rather thick gathering of hot glass which remains is then blown to thin it out and to round off the seal.

The area of glass actually worked during the sealing-in process is very small and therefore, the heads on the sealing machines and the burners must be accurately placed. An under-melted seal develops an internal crevice between the stem and bulb and may crack in service. An over-melted seal results in an excessively softened stem and may cause movement of the nickel contact-pins in the stem.

During the last stages of the sealing-in machine cycle the stem is lightly tempered on the outside by a jet of cold air; this ensures compressive surface stresses in the base and increases the resistance of the base to lateral forces on the nickel-contact pins.

The gas-oxygen sealing flames leave a marked "strain ring" about 3/8-inch up the bulb and the glass is likely to split cleanly around this ring if the flames are not reduced in intensity. A bushy gas-air flame is therefore directed on to the bulb at the level of the expected ring strain. This reduces the steep temperature gradient along the bulb, and hence, reduces the intensity of the stress. The sealed-in mount is then passed over to the exhausting machine, where it is pumped, processed and sealed-off.

The object of tipping-off is to seal the valve permanently after evacuating the air. In order that the tip shall not break off, crack or admit air at any time after pumping, it is important that the inside and outside surfaces of the tip shall be as free as possible from crevices or sharp re-entrants. This requirement is difficult to meet, since the softened, hot glass tends to be sucked-in up the exhaust tube to form an internal bubble which meets the inside surface of the tube in a sharp crevice.

Experience has shown that tipping off can best be carried out in the following sequence:

(a) Small burners preheat the exhaust tube at slightly nearer the valve than the tipping-off point, until the tube is on the point of sucking in.

(b) Small burners are applied to the tip-off point and under their influence the exhaust tube starts to suck in. Because of the preheat, the inside of the tube tends to form a cone (opening out towards the valve).

(c) A gentle pull on the valve draws out the softened, closed-up portion of the exhaust tube and lifts the valve out of the tipping burners, thereby avoiding further suck-up.

(d) The tipping burners then play on the constricted rod and a further small lift of the valve parts it off.

A good tip is symmetrical, short, free from sucked-in air bubbles and crevices, caused by sucked-in glass, are kept to a minimum.

In regards to the choice of glasses used in miniature valves in the case of the stem glass, the main factor limiting the choice of glass is that of thermal expansion, for if the stem glass does not match the expansion coefficient of the lead-wire, it will crack along the seals and the vacuum will be spoiled. The lead-wire material which forms the vacuum seal is a wire consisting of a

(*Continued on page* 550)

Glass Division Meeting . . .

(*Continued from page* 524)

cient of expansion up to a critical TiO_2 concentration and a *negative "factor"* for coefficient of expansion beyond this TiO_2 concentration.

Refractive index results revealed that TiO_2 had a positive "factor" refractive index values deviating rapidly from the expected straight line relationship at higher TiO_2 concentrations. K_2O had (1) a positive factor and (2) a zero factor and (3) a negative factor in the presence of < 20 per cent TiO_2; 20 per cent TiO_2 and > 20 per cent TiO_2 concentrations respectively in the glasses."

A case was presented for the "titanium anomaly."

The next paper, "Proposed Theory for the Potash-Silica-Titania Glass System," by W. E. Hauth, Jr. and Bh. V. Janakirama-Rao, International Resistance Co. was also presented by Mr. Hauth.

"Titanium dioxide was substituted for silica in various potash-silica glasses up to 55 per cent TiO_2. The physical, chemical and dielectric properties were investigated and a theory is proposed concerning the role of the titanium ion in such glasses. It is postulated that titanium replaces silicon in the network causing (1) an increased bond strength between potassium and oxygen ions when the oxygen is bonded to titanium and (2) a weakening of the network due to distortion of the tetrahedra by the larger titanium ion. These two mechanisms give rise to apparent anomalies in several of the properties in this glass system."

Titania glasses have been made with as low as 2 per cent SiO_2. The experimental work would have been more amenable to interpretation if the substitutions had been made on a molar basis.

The paper which followed was "Glass Surface Studies I: Topography and Film Thickness Determinations," by J. Francl and J. S. Logiudice, of Owens-Illinois Glass Company, Toledo, Ohio. The paper was presented by Mr. Francl.

Various methods of film thickness determination were critically reviewed. The various methods were classified as follows:

(1) Mechanical Methods
  (a) Stylus instruments
  (b) Microbalance
  (c) Molecular ray
(2) Optical Methods
  (a) Reflected color
  (b) Polarimeter
  (c) Electron microscope
  (d) Phase contrast
  (e) X-rays
(3) Electrical Methods
  (a) Electrolysis
  (b) Resistance
  (c) Ionization
(4) Interferometer Method
  (a) Double-beam
  (b) Multiple-beam
  (c) Equal chromatic order
(5) Tracer Methods

The multiple-beam interferometer method was found advantageous for diversified surface investigations. Specific examples of topography studies and thickness determinations of thin films deposited on glass surfaces were also given. Such studies are hoped to be of aid ultimately in studying grinding and polishing of glass as well as durability, etching and reflection.

The final paper, "Volatilization of Alkali from a Glass Surface," by J. S. Logiudice and J. Francl, Owens-Illinois Glass Company, Toledo, Ohio, was presented by Mr. Logiudice.

Volatilization of alkali (sodium) from the surface of a commercial glass was studied by collecting the volatilized alkali on aluminum targets in vacuum and at an elevated temperature. The alkali (sodium) was then analyzed by flame-photometer technique. The amount of alkali collected at low temperature (below 980°F.) was negligible but with increase in temperature the volatilization increased rapidly. The volatilization appears to be related to the expansion characteristic of the glass.

At the business meeting which followed the lengthy technical sessions, the following officers were nominated by the nominating committee:

Trustee—L. G. Ghering, Preston Laboratories, Butler, Pennsylvania.

Chairman—J. Earl Duncan, Pittsburgh Plate Glass Company, Creighton, Pennsylvania.

Vice Chairman—O. L. Anderson, Bell Telephone Laboratories, Murray Hill, New Jersey.

Secretary—F. V. Tooley, University of Illinois, Urbana, Illinois.

A discussion of an improved schedule for the Fall Meeting was made but no definite recommendations were forthcoming. Following the report of the various committees the meeting was adjourned until the Spring Meeting to be held at the Hotel Statler, New York City, April 22-26, 1956.

APPOINTMENT AT COLORADO FUEL AND IRON

Hubert B. Smith has been appointed director of product engineering at the Claymont, Delaware plant of The Colorado Fuel and Iron Corporation, it was announced by A. F. Franz, President. Mr. Smith will supervise production at the plant in all stages from the research and development of products and processes to the control of quality.

Mr. Smith was formerly vice president in charge of research with the Great Lakes Steel, starting as assistant chief metallurgist, later as chief metallurgist and assistant vice president in charge of metallurgical control.

COURT DISMISSES SUIT

In a decision of major importance in the glassware industry, Judge John H. Druffel, of the United States District Court in Cincinnati, has dismissed the suit brought by Corning Glass Works against The Federal Glass Company.

The suit, of many years standing, alleged infringement by The Federal Glass Company of two Corning patents relating to tempered or strengthened glass tumblers sold by Federal under its trade-mark "Sturdee."

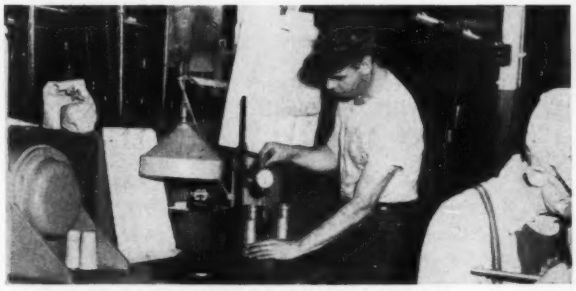
The Court, in dismissing Corning's claims, also awarded costs of the suit to Federal.

many eyes, many gauges . . .

check every Overmyer mould

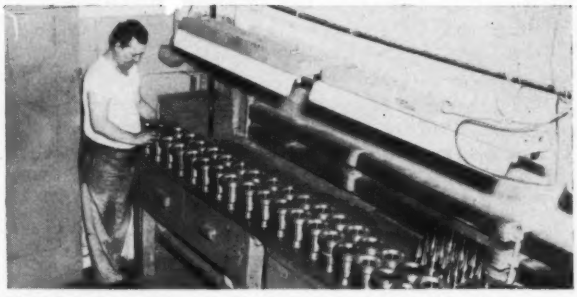
Primary Inspection of Rough Castings

Floo Inspection of First Machine Operation



Continuous Inspection with Precision Instruments

Precision Testing of Tolerances



Final Inspection of Measurement Specifications

Through every phase, every operation—from the raw casting to the shipping room, each Overmyer mould must pass rigid inspection. Aided by many scientific testing devices and gauges, the exacting eyes of trained inspectors seek out any flaw or variation so that every mould meets the specified high standards of the Overmyer Mould Company.

Testing devices, some specially designed for mould equipment, are used in the many step-by-step inspections. To maintain a quality control program assuring the glass industry trouble free moulds conforming to each customer's exacting specifications, is an Overmyer Objective.

Overmyer

A PART IN THE PROGRESS OF GLASS

MOULD COMPANY, INC.

General Offices, Main Plant and Foundry Division: Winchester, Indiana
Eastern Plant: Greensburg, Pennsylvania
Western Plant: South Gate, California

Surface Durabilities . . .

(*Continued from page* 519)

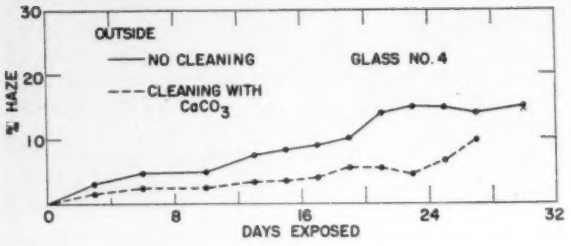


Fig. 17. Comparison of method of cleaning of outside of bottle (glass No. 4). Glass Composition: SiO_2 71.7, R_2O_3 1.9, CaO 11.2, MgO 1.1, BaO 0.62, Na_2O 13.1, K_2O 0.37%.

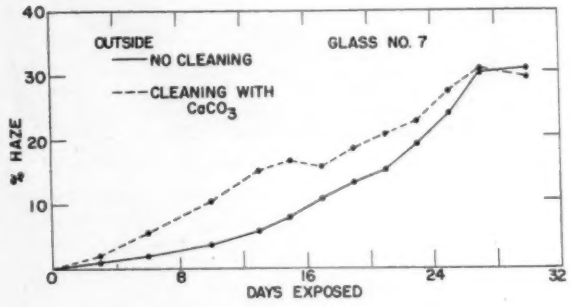


Fig. 18. Comparison of method of cleaning of outside of bottle (glass No. 7). Glass composition: SiO_2 71.2, R_2O_3 1.5, CaO 10.2, MgO 2.8, BaO 0.62, Na_2O 13.4, K_2O 0.29%.

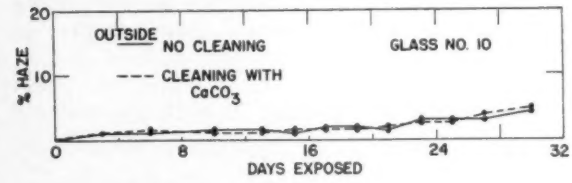


Fig. 19. Comparison of method of cleaning of outside of bottle (glass No. 10). Glass composition: SiO_2 72.3, Al_2O_3 3.4, Fe_2O_3 0.85, CaO 3.9, MgO 3.1, Na_2O 14.5, K_2O 1.4%.

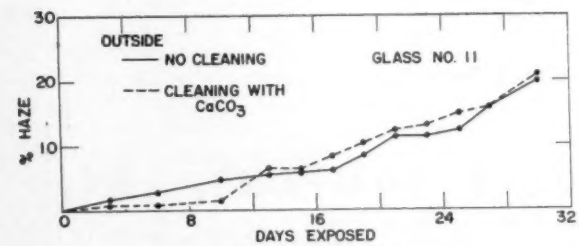


Fig. 20. Comparison of method of cleaning of outside of bottle (glass No. 11). Glass composition: SiO_2 71.4, R_2O_3 1.4, CaO 11.0, MgO 2.7, BaO 0.0, Na_2O 13.0, K_2O 0.28%.

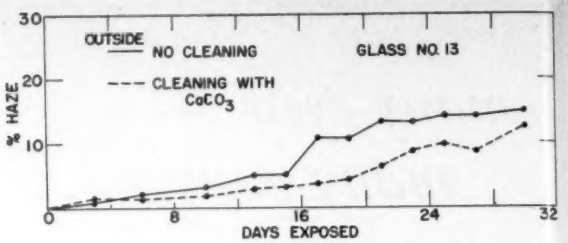


Fig. 21. Comparison of method of cleaning of outside of bottle (glass No. 13). Glass composition: SiO_2 71.3, R_2O_3 1.8, CaO 6.3, MgO 4.2, BaO 0.98, Na_2O 14.9, K_2O 0.07, volatiles 0.40%.

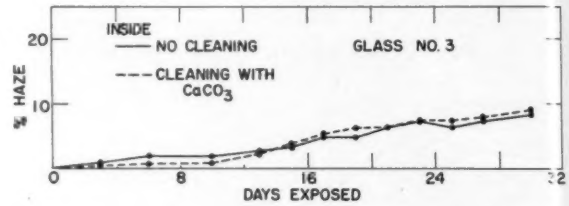


Fig. 22. Comparison of method of cleaning inside of bottle (glass No. 3). Glass composition: SiO_2 71.0, R_2O_3 1.4, CaO 8.1, MgO 5.6, BaO 0.62, Na_2O 12.9, K_2O 0.35%.

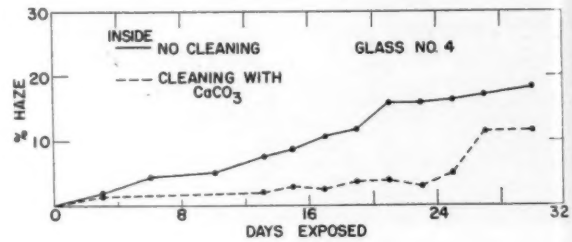


Fig. 23. Comparison of method of cleaning inside of bottle (glass No. 4). Glass composition: SiO_2 71.7, R_2O_3 1.9, CaO 11.2, MgO 1.1, BaO 0.62, Na_2O 13.1, K_2O 0.37%.

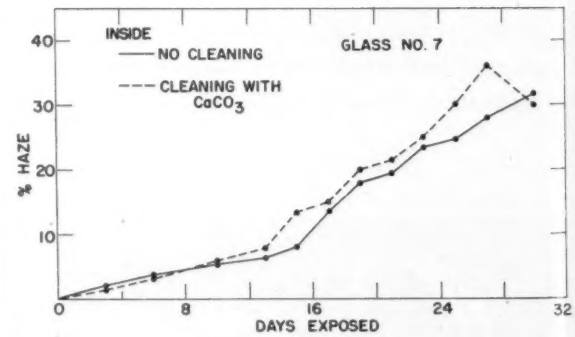


Fig. 24. Comparison of method of cleaning inside of bottle (glass No. 7). Glass composition: SiO_2 71.2, R_2O_3 1.5, CaO 10.2, MgO 2.8, BaO 0.62, Na_2O 13.4, K_2O 0.29%.

(*Continued on page* 536)

Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during July 1955 was a follows: *Flat Glass:* A preliminary figure of 29,000 for July indicates a decrease of 1.4 per cent from the adjusted 29,400 reported for June. *Glass and Glassware, Pressed and Blown:* A decrease of 6 per cent is shown by the preliminary July figure of 75,500 when compared with June's 80,300. *Glass Products Made of Purchased Glass:* The preliminary 13,800 indicates a decrease of 6.1 per cent from the previous month's 14,700.

Payrolls in the glass industry during July 1955 were as follows: *Flat Glass:* A decrease of 8 per cent is shown in the preliminary $13,115,830 when compared with June's adjusted $14,261,156. *Glass and Glassware, Pressed and Blown:* A decrease of 7.5 per cent is shown in the preliminary $24,246,322 reported for July when compared with the previous month's adjusted $26,222,768. *Glass Products Made of Purchased Glass:* A preliminary figure of $3,870,256 was reported for July. This is a decrease of 4.8 per cent compared with the adjusted June figure of $4,065,970.

GLASS CONTAINER SHIPMENTS
(All Figures in Gross)

Narrow Neck Containers	August 1955
Foods	1,852,000
Medicinal & Health Supplies	1,441,000
Chemicals, Household & Industrial	961,000
Beverages, Returnable	767,000
Beverages, Non-returnable	164,000
Beer, Returnable	200,000
Beer, Non-returnable	945,000
Liquors	773,000
Wines	371,000
Toiletries & Cosmetics	965,000
Sub-total (Narrow)	8,439,000
Wide Mouth Containers	
Foods	*4,542,000
Dairy Products	329,000
Medicinal & Health Supplies	442,000
Chemicals, Household & Industrial	223,000
Toiletries & Cosmetics	179,000
Packers' Tumblers	207,000
Sub-total (Wide)	5,922,000
Total Domestic	14,361,000
Export Shipments	243,000
TOTAL SHIPMENTS	14,604,000

*This figure includes Fruit Jars and Jelly Glasses.

GLASS CONTAINER PRODUCTION AND INVENTORY
(All Figures in Gross)

		Production August 1955	Stocks August 1955
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries and Cosmetics	Narrow Neck	4,914,000	4,772,000
	Wide Mouth	*4,387,000	4,139,000
Dairy Products		295,000	322,000
Beverages, Returnable		795,000	1,145,000
Beverages, Non-returnable		171,000	249,000
Beer, Returnable		229,000	303,000
Beer, Non-returnable		874,000	642,000
Liquors		925,000	1,067,000
Wines		340,000	462,000
Packers' Tumblers		179,000	162,000
TOTAL		13,109,000	13,263,000

*This figure includes Fruit Jars and Jelly Glasses.

Glass container production, based on figures released by the Bureau of Census, was 13,109,000 gross during August 1955. This represents an increase of 10.6 per cent from the previous month's production of 11,858,000 gross. During August 1954, glass container production was 11,386,000 gross or 15.1 per cent under August this year. At the end of the first eight months of 1955, glass container manufacturers have produced a total of 91,826,000 gross. This is 6.5 per cent over the 86,188,616 gross produced during the corresponding 1954 period.

Shipments of glass containers during August 1955 increased 30.4 per cent to reach 14,604,000 gross. This is an increase from July shipments which were 11,205,000 gross. Shipments during August 1954 were 11,231,000 gross or 30.4 per cent under August 1955. At the end of the first eight months of 1955, shipments have reached a total of 90,864,000 gross, which is 10.3 per cent over the 82,398,195 gross shipped during the corresponding period last year.

Stocks on hand at the end of August 1955 were 13,263,000 gross. This is 10 per cent below the 14,805,000 gross on hand at the end of July 1955 and 10.4 per cent lower than the 14,360,000 gross on hand at the end of August 1954.

Automatic tumbler production during July 1955 was 4,916,468 dozens. This is a loss of 13.3 per cent against the June 1955 production which was 5,668,678 dozens. Production during July 1954 was 3,943,087 dozens. Shipments during July 1955 dropped to reach 4,568,209 dozens. This is 17.3 per cent lower than June's 5,527,019 dozens. During July 1954, shipments were 4,615,737 dozens. At the end of the 12-months period ending July 1955, shipments have reached a total of 61,587,975 dozens, which is a 1 per cent increase from the 61,005,785 dozens shipped last year.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware during July 1955 decreased 20.8 per cent to reach 2,371,834 dozens. This is a decrease from June's 2,995,743 dozens. During July 1954, sales were 2,605,881 dozens. At the end of the 12-month period ending July 1955, manufacturers had sold a total of 37,476,670 dozens which was .02 per cent higher than the 37,471,170 dozens during the corresponding 1954 period.

Surface Durabilities . . .

(*Continued from page* 534)

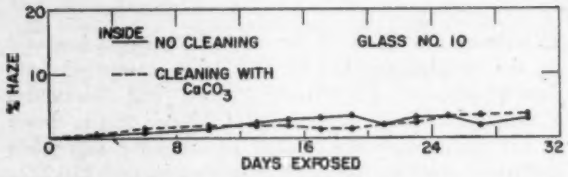


Fig. 25. Comparison of method of cleaning of inside of bottle (glass No. 10). Glass Composition: SiO_2 72.3, Al_2O_3 3.4, Fe_2O_3 0.85, CaO 3.9, MgO 3.1, Na_2O 14.5, K_2O 1.4%.

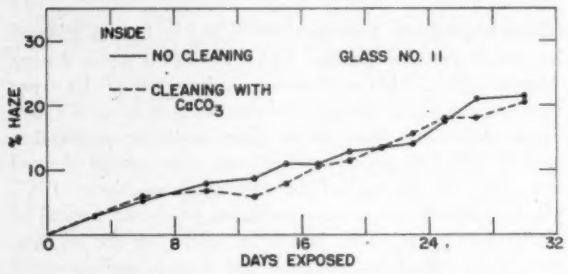


Fig. 26. Comparison of method of cleaning inside of bottle (glass No. 11). Glass composition: SiO_2 71.4, R_2O_3 1.4, CaO 11.0, MgO 2.7, BaO 0.0, Na_2O 13.0, K_2O 0.28%.

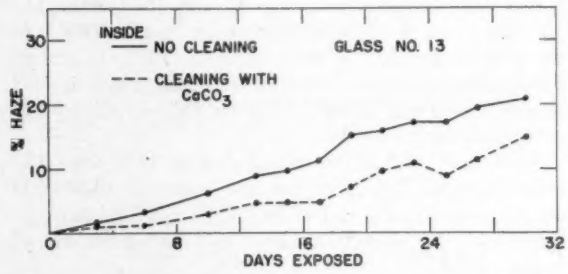


Fig. 27. Comparison of method of cleaning inside of bottle (Glass No. 13). Glass composition: SiO_2 71.3, R_2O_3 1.8, CaO 6.3, MgO 4.2, BaO 0.98, Na_2O 14.9, K_2O 0.07, volatiles 0.40%.

IV. Warehouse Tests

In order to determine what correlation may exist between the haze meter tests and practical warehouse storage tests, the following procedure was undertaken. Samples of bottles from the same lots tested in the laboratory were sent to San Juan, Puerto Rico, where they were stored in an unheated warehouse for twelve months. The bottles were stored in cardboard cartons in the conventional manner. The climatic conditions in this locality are severe and known to be quite favorable to the weathering of glass. After twelve months storage the bottles were returned, carefully examined, and the water-soluble alkali determined on the inside surface.

In order to determine the surface appearance, the bottles were examined with the naked eye under the beam of a microscope lamp and also by observation while held up to natural daylight. The bottles were then judged as C = clear, LH = light haze, MH = medium haze.

Determination of Water-Soluble Alkali

The bottle was first blown out with clean, dry air to remove carton dust. The entire inside surface of the bottle was then rinsed with five successive 20 ml. portions of purified water. The rinsings were then combined in a Pyrex-brand 250 ml. Erlenmeyer flask and titrated to the approximate methyl red end point with 0.02*N* H_2SO_4. One milliliter of the standard acid was then added in excess and the solution boiled briefly to remove CO_2. The solution was then back titrated with 0.02*N* NaOH to the methyl red end point. The net titer was then calculated to micrograms of Na_2O per square centimeter of inside bottle surface.

TABLE I

Weathering Test Results on Various Containers

Glass Number	#5	#3	#11	#8	#4	#1	#2	#12
Micrograms $Na_2O/cm.^2$ (Water Soluble)								
Stored in the laboratory	0.6	0.3	0.4	0.4	0.6	0.4	0.6	0.5
Stored in Puerto Rico	0.5	3.7	1.1	1.4	2.0	3.0	1.4	2.5
General Appearance								
As rec'd from P. Rico	C	LH	LH	LH	MH	MH	MH	MH
After water rinse....	C	C	LH	LH	C	LH	C	C

C = Clear, LH = Light haze, MH = Medium haze

Table I shows the results obtained on one bottle of each of the eight kinds. The amount of water-soluble alkali found on similar bottles that had been stored in a heated laboratory building and were unweathered has been included to serve as a basis for comparison. It should also be pointed out that the appearance as shown in the table is stated in general terms only although it is not unusual for similar bottles stored side by side under the same conditions to show different detailed appearances. For instance, one bottle may have a uniform, amorphous-looking deposit on the inside surface while a duplicate bottle may show small aggregates of crystalline material separated by clear areas. Examples of this were noted in the present lot of bottles.

V. Discussion of Results

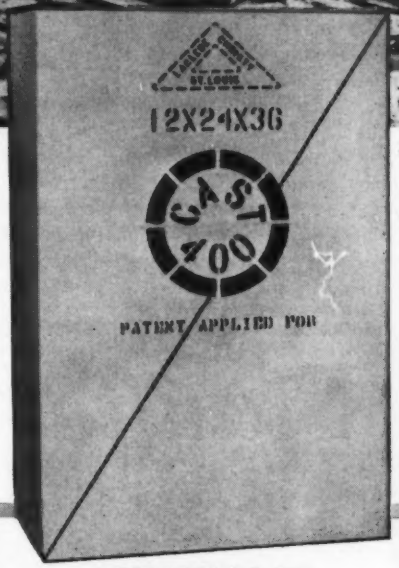
In each instance, haze meter determinations were made on both the inside and the outside of the bottle. One significant fact seemed to be apparent in this study: the inside usually corroded faster than the outside. There were some exceptions to this generalization, but as a rule the inside appeared to be more sensitive to attack by moisture than the outside. The marked influence of the composition of the glass on the type of haze meter curve is indicated by the following figures:

(a) Glasses, 2, 6, 9, and 12 are examples of rather poor surface durability. These glasses all show a definite breakdown after 15 days' exposure, and the ultimate haze produced after 30 days' exposure is approximately 40 per cent or more. These glasses all contain a high percentage of CaO with little MgO. In other words, the RO content is made up principally of CaO. It is also evident that the CaO was furnished by high-calcium lime. These are shown in Figures 4-7.

(b) Glasses 4, 7, 8, and 11 contain a greater amount of MgO (about 1.0—2.8 per cent), and the CaO content

(*Continued on page* 540)

THATCHER SETS RECORD WITH LACLEDE-CHRISTY CAST 400



Cast 400 Bottom Blocks deliver 199 tons pull per sq. ft. of melter

This 1,084-day service of Thatcher Glass Manufacturing Company, Inc. demonstrates Thatcher's outstanding design and operation—and again proves the extraordinary merits of Laclede-Christy CAST 400 Bottom Blocks. The campaign produced 199 tons of glass per square foot of melting end for the life of the furnace. At campaign's end, 12-inch CAST 400, in the melter bottom, was 8 inches thick at the thinnest place.

Evidence from *many* completed furnace campaigns, using the best known engineering practices and various refractories, shows that *you can always expect a maximum campaign from CAST 400.*

CAST 400 Bottom Blocks also afford economy of construction. They are laid up quickly and easily.

If you are not getting these advantages, don't you think you should?

OPERATING DATA

Area of melting end	684 sq. ft.
Depth of melting end	42 in.
Type of glass melted	Soda Lime Flint
Total days	1,084
Operating days	1,071
Total glass produced	136,130 tons
Tons glass per sq. ft. melting end	199 tons
Average pull per day	127 tons
Average rate of pull per sq. ft. melting end, per ton	5.3 sq. ft.

LACLEDE-CHRISTY COMPANY

DIVISION OF H. K. PORTER COMPANY, INC.

2000 Hampton Avenue • St. Louis 10, Missouri

Mission 7-2400

HKP — LACLEDE-CHRISTY COMPANY — Quality First

A. M. Kohler

J. E. Brinckerhoff

A. M. KOHLER RETIRES

A. M. Kohler, vice president of The Babcock & Wilcox Company and head of its Refractories Division, has retired from the company and active charge of the Refractories Division has become the responsibility of J. E. Brinckerhoff as manager, according to an announcement made recently by Alfred Iddles, president of the company.

Mr. Kohler joined the company in 1913 at its former Bayonne, N. J. plant. He was placed in charge of development work in the refractories field, when, in 1920, the company decided to engage in that field. In the same year he opened a refractories plant at East Liverpool, Ohio and served as manager of the refractories project. As the work expanded, he directed development and construction of a larger plant at Augusta, Georgia and was appointed general manager of the company's refractories division in 1930. He was elected a vice president in 1947.

Mr. Brinckerhoff joined The Babcock & Wilcox Company in 1919 after service with the U. S. Army in France during World War I. Upon completion of his student engineer training at the company's Bayonne plant, he was assigned to the development of refractories and sent to East Liverpool. When the work progressed to the production stage, Mr. Brinckerhoff was named sales manager of the Refractories Division in which position he organized and built up the division's sales department. He was appointed manager of the division in 1953.

During World War II, Mr. Brinckerhoff served on the O.P.A. and W.P.B. Refractories Industry Advisory Committees and was vice commander of civilian defense for Orange, N. J.

PACIFIC COAST BORAX COMPANY INCREASES ITS SALES FORCE

F. T. Winters, Jr., manager of the Pacific Coast Borax Company's Agricultural Sales Division, has announced the appointment of two additional sales representatives in the United States.

Joseph S. Gowland is assigned to the company's office at Chicago. He will handle weed control and other products of the division in a portion of Illinois, Indiana and lower Michigan.

Mr. Elmer H. Schmierer will be working out of the Agricultural Sales Division's district office at Kansas City, Missouri. Mr. Schmierer will do sales contact work in Nebraska and Missouri.

Stauffer Chemicals

basic for ceramics and glass

One way to reduce the variables present in the complex operations of ceramic and glass manufacturing is to demand raw materials of consistently high quality. Stauffer Borax and Boric Acid, for example, are produced continuously in accordance with high purity standards, and every carload conforms to top manufacturing specifications. STAUFFER CHEMICAL COMPANY, 380 MADISON AVENUE, NEW YORK 17, N. Y., Sales Offices in principal cities.

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BORAX — Anhydrous • Pentahydrate • Decahydrate

BORIC ACID — U. S. P. • Technical

Caustic Soda • Copperas* • Cream of Tartar • Potassium Nitrate

Sodium Sulphate* • Sodium Silico Fluoride* • Sulphuric Acid • Sulphur

*west coast only

Stauffer CHEMICALS SINCE 1885

STAUFFER CHEMICAL COMPANY

Improved Glass Fibers . . .

(*Continued from page* 525)

fiber suspension on the wire of the papermaking machine and the fibers are pressed together, this gelatinous layer acts as an adhesive to bond the fibers together in the paper. The pH value must be below 4 to obtain this effect, and the tensile strength increases as the pH decreases in the range studied (down to 2.9). Ionizable acid is drained off during the formation of the sheet, so that the pH of the finished paper is effectively neutral—from 7.0 to 7.4.

The use of acid also causes rapid dispersal of the fibers in the beater. It is known that negative electrical charges appear on the surface of the glass, and the mutual repulsion of the like-charged surfaces is probably responsible for the quick separation of the fibers.

A temperature of 85° F. in the beater likewise aids in promoting dispersion of the glass fibers. The decreased viscosity and interfacial tension of the heated water apparently causes it to wet and penetrate the fiber bundles more readily.

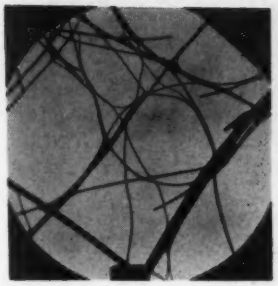

Fig. 1

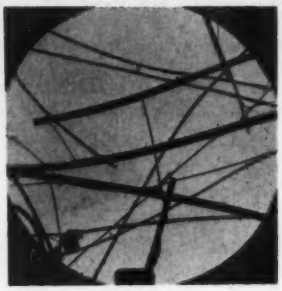

Fig. 2

Fig. 1. Electron micrograph of the higher strength glass-fiber paper. Small quantities of gelatinous binding material can be seen at most of the intersections of the fibers. The gelatinous layer, which results in greater strength, was formed by the addition of sulfuric acid to a pH of 3.4 during the paper making process.

Fig. 2. Electron micrograph of glass fibers acidified to a pH of 3.8. Note the absence of adhesion between the fibers. Practically no gelatinous layer is formed on the fibers at pH values greater (i.e., less acid) than 3.5.

ROBERT S. HOLT NAMED PRESIDENT OF BRYCE BROS.

Directors of Bryce Brothers Company have just named Robert S. Holt president of that company.

Mr. Holt succeeds Carl Kohl who died last winter.

● After eight years of experimental use on the West Coast and at selected localities in the rest of the nation, Fiberglas reinforced built-up roofs now are being promoted throughout the United States by Owens-Corning Fiberglas Corporation as a completely new innovation in roof construction.

The development stems from the company's experiences in the use of glass fibers to reinforce plastics and basically is the same—fibers of glass are used to reinforce bitumen on roofs.

GLASS MELTING FURNACE CONSTRUCTION

OUR SPECIALTY

NEW FURNACES—REMODELING

HOT REPAIRS

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Surface Durabilities . . .

(*Continued from page* 536)

varies from 10.0—11.0 per cent. These glasses show some improvement in durability over those considered in (a) above. The total percentage of haze developed in 30 days was approximately 20-30 per cent. The results are shown in Figures 8-11.

(c) Glasses 3 and 13 were still better in their resistance to attack. The chemical composition indicated the ratio of CaO/MgO to be approximately unity. It is therefore indicated that dolomite was used as a source of RO in these glasses. These are shown in Figures 12 and 13.

(d) The best glasses of the group were 5 and 10 containing high Al_2O_3. The percentage haze developed after 30 days' exposure was quite small (about 5 per cent). The Al_2O_3 content varied from approximately 3.5 to 9.5 per cent. This high Al_2O_3 content seems to offer definite improvement in weatherability. These glasses are illustrated by Figures 14 and 15.

The results are in thorough agreement with those reported in a previous paper[4] in which all samples were cleaned by means of a calcium carbonate slurry. In order to compare the results directly, however, the results of six different glasses, one of which was cleaned by calcium carbonate slurry and the other in which no previous cleaning treatment was used, are shown in Figures 16-21 inclusive. These comparisons are made on the basis of the haze developed on the outside of the container. The results of similar comparisons made on the inside of the container are shown in Figures 22-27 inclusive. It should be pointed out that these determinations were also made by different individuals and indicate that the personal factor has not influenced the results to any marked degree. Comparing results of tests made on samples cleaned by means of calcium carbonate slurry and those used as received direct from the annealing lehr shows that the haze meter curves are very similar.

The results of the powder durability tests were rather erratic. They showed that the percentage Na_2O extracted, varied from .057 to .030 per cent. The maximum value appears to be high for this type of glass. No direct correlation was seen between these tests and the haze meter tests.

The warehouse tests indicated a definite similarity in the appearance, after storage for one year in Puerto Rico, to the results as shown in the haze meter curves. Glasses 5 and 3 were the best. Glasses 2 and 12, on the other hand, were the poorest and the remaining glasses occupied an intermediate position. This good correlation in appearance, however, of the weathered samples as compared to the haze meter curves was not substantiated as nicely by the water solubility tests. It is hoped that by further investigations the haze meter tests may serve as a very useful device for predicting the weatherability of glass products.

VI. Conclusions and Recommendations for Future Work

The results obtained indicate little difference in the amount of haze developed on samples tested, as received from the annealing oven and those cleaned with a calcium carbonate slurry and thoroughly washed with distilled water before testing. Therefore, it is concluded that scrubbing with calcium carbonate before testing is not a necessity of the test, provided that clean samples can be furnished directly from the manufacturer. It, therefore, appears safe to test such samples as received directly from the annealing lehr.

The results further indicate that cleaning with a calcium carbonate slurry had little influence on the weathering characteristics of the surface.

It is also concluded from the results obtained that little, if any, correlation exists between surface haze tests and powder durability tests.

Now that it has been established that containers can be tested directly as received from the annealing lehr, providing they have been carefully packed and shipped, it is recommended that testing now be conducted on the container itself. It is desired that the influence of the size of the mouth opening be considered and that the deterioration ratio between inside and outside of the container be studied when it is tested as an unmutilated unit. This can be accomplished if the size of the containers be kept within the limits of the humidity cell.

Acknowledgment

The author is indebted to B. J. Conner and F. L. Waith for their capable assistance in the laboratory work.

Acknowledgment is due to R. L. Quarles, Union Carbide and Carbon Corporation Fellowship at Mellon Institute, Pittsburgh, Pennsylvania, for suggestions in regard to the development of a desirable replica technique.

LOOK
TO
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FIRST IN RARE EARTH · A GRAM OR A CARLOAD

FOR CERIUM, Didymium (cerium-free) Salts, Neodymium and other Rare Earth Salts to color and decolorize glass

FOR CEROX, the original 90% optical grade cerium oxide for the fastest glass polishing.

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MEETINGS TO BE HELD

AMERICAN CERAMIC SOCIETY MEETING

Professor Egon Orowan, of the Massachusetts Institute of Technology, will present a paper entitled "*Fracture and Strength of Glass*" before the New England Section of the American Ceramic Society. This is the first of many interesting papers that will be presented this year in conjunction with the local meetings.

Professor Orowan's talk will be given on October 19th at The Maridor, Route 9, Framingham Centre, Massachusetts, after a short business meeting and dinner.

The New England Section would like to extend an invitation to anyone who is in this section of the country and would like to attend. Please contact Dr. S. L. Blum, Research Division, Raytheon Manufacturing Company, Waltham, Mass., for reservations.

19TH ANNUAL TIME AND MOTION STUDY AND MANAGEMENT CLINIC SCHEDULED FOR NOVEMBER

More than 2,000 production executives and methods engineers are expected to attend the 19th Annual Time and Motion Study and Management Clinic sponsored by the Industrial Management Society, November 9, 10, 11, 1955 at the Hotel Sherman, Chicago.

Thirty leading authorities from management, labor and industry will discuss the latest developments in the fields of time study, motion economy, job evaluation, production control, methods, plant layout, incentives and human relations. In addition to the technical sessions, an industrial exhibit will be held featuring new products, processes, and services applicable to the industrial engineering field.

Feature of the event will be the Annual Methods Improvement Competition, with awards to companies and colleges for outstanding advances in industrial engineering techniques and applications.

SOCIETY OF RHEOLOGY 1955 ANNUAL MEETING

The Society of Rheology will hold its Annual Meeting in New York City at the Henry Hudson Hotel, November 24, 1955.

Registration starts at 9:00 A.M., November 2nd, with the first technical session beginning at 2:00 P.M. This session will be concerned primarily with plasticity studies of metals.

Two technical sessions will be held on November 3rd. The morning session will be devoted to flow phenomena encountered in geological studies, and the afternoon sessions of November 3rd and 4th will cover papers on a number of different subjects, including hypoelasticity, fracture of viscoelastic liquids and determination of dispersion structure by viscometry.

The morning session on November 4th will be devoted to papers on the rheology of polymetric materials.

As in the past, non-members are welcome to the meeting. Complete programs are available from: F. D. Dexter, Bakelite Company, Bound Brook, New Jersey.

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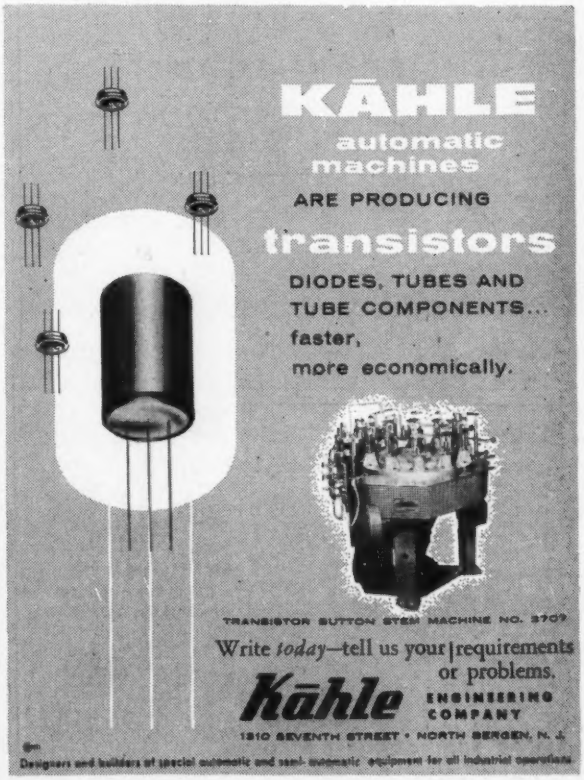

Inventors and Inventions . . .

(*Continued from page* 529)

heat at a temperature of approximately 600°F. or about 315°C. When this constituent of the dispersion is eliminated by volatilization, the nonconducting characteristics of the composition are substantially eliminated leaving the colloidal graphite and carbon black as the current conducting coating or film. In the volatilization step of the process, the triethyl cellulose constituent is substantially oxidized and any moisture absorbed thereby is evaporated under the curing temperature. The dispersion is blended with a suitable carrier or vehicle boiling below 100°C. and including dichloromethane has been found to function satisfactorily and to have the necessary characteristics of low surface tension to facilitate the spreading or flowing of the composition upon the glass surface of the tube. In the composition or admixture of the carrier and dispersion, the dispersion is blended in the ratio of the entire composition of substantially fifteen parts by weight of dispersion to eighty-five parts by weight of dichloromethane (CH_2Cl_2).

The patent contains 10 claims and 12 references.

Miscellaneous Processes

Method of Cleaning Glassworking Tools. Patent No. 2,701,220. Filed December 22, 1953. Issued February 1, 1955. No drawings. Assigned to Corning Glass Works by Rowland D. Smith.

This invention relates to a novel method of cleaning the glass-contacting surface of a glass-working tool attached to a blowing, pressing, rolling or other glass-forming machine while such machine is in operation. Plungers, molds, shaping rolls and the like, which are utilized in the automatic forming of glassware, periodically accumulate on their glass-contacting surfaces a condensation or residue of glass-fumes such as compounds of alkali-metals, boron, arsenic, lead and the halogens. As such a deposit accumulates on the working tool, a corresponding haze pattern is impressed on the ware being produced. Such difficulties can be overcome and the objectionable residue can readily be removed from such a tool, while at working temperature, by directing against such residue a blast of dry particles of a solid ammonia derivative. Suitable solid ammonia derivatives include ammonium salts of inorganic acids, such as the bicarbonate, sulfate, nitrate and chloride; ammonium salts of organic acids, such as, the acetate, oxalate, succinate and tartrate; and amino compounds, such as, urea, biuret, glycine and glycolamide. Ammonium bicarbonate is particularly suitable because it is crystalline, nonhygroscopic and stable at room temperature yet decomposable below 100°C., does not produce noxious or objectionable fumes and is cheap and easily available.

This patent contains three claims and no references were cited.

Improved Fluorescent Lamp. Patent No. 2,709,644. Filed February 27, 1951. Issued May 31, 1955. One sheet of drawings: none reproduced. Assigned to Westinghouse Electric Corporation by Daniel S. Gustin.

When two phosphor-coated bulbs bump together, the surface friction of the bulbs causes them to seize, or to have their contacting external surfaces take hold suddenly and forcibly and mutually nick, scratch, or cut said external surfaces at the point of contact. The intimate bond between the inner surface of the bulb and the coating is broken at the point of impact. Gaseous material fills the newly-created void and either further impact or bulb evacuation can complete the removal of the weakened portion of the coating from the inner bulb wall.

It has been found advantageous, to wash bulb envelopes with a hot, two to ten per cent by weight, colorless solution of aluminum sulphate on the inside surface, and/or on the outside surface. The alkali in the glass at its surface presumably combines with the sulphate ions in the solution to form alkali sulphates, thereby reducing the alkali metal content on the glass surface and leaving the surface richer in silica. The alkali sulphate and excess aluminum sulphate are removed during the usual hot water bulb washing operation. The resulting surfaces acquire a lower hardnes of the treated surface and its resistance to abrasion is increased. After treatment, when two pieces of glass are bumped together, there is less tendency to seize, and the force of the impact is lessened. As a result, chipping of the phosphor coating is decreased and the light output maintenance of the finished lamp is improved.

There was one claim and two references cited in this patent. 1,791,066, Smith, Feb. 3, 1931; and 2,175,076, Burch, Oct. 3, 1939.

● The Brockway Glass Company, Inc. announced the addition of Mr. Al Beltz to the staff of its New York City office. Mr. Beltz was formerly with the Hazel-Atlas Glass Company.

THE SHARP-SCHURTZ COMPANY

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solves glass problems!

Since 1920, designers and builders of special machinery and equipment for the glass industry . . .

Glass Lathes • Glass Cutters • Wet or Dry Silent Blast Torches • Cross Fires • Ribbon Fires • Gas and Oxygen Burners • Indexing Turntables • Sealing, Ampule and Bulb Blowing Machines, etc.

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Charles Eisler, Jr.
President

BAR ASSOCIATION ELECTS FULLER

Fred E. Fuller, general counsel for Owens-Illinois Glass Company and a prominent Midwestern corporation lawyer, has been elected chairman of the Anti-Trust Section of the American Bar Association, which held its 78th annual meeting in Philadelphia during the week of August 22nd.

Mr. Fuller, one of the nation's leading anti-trust lawyers, was appointed by Herbert Brownell, Jr., to the U. S. Attorney General's National Committee to Study Anti-Trust Laws.

He is a senior partner in the Toledo law firm of Fuller, Harrington, Seney and Henry in addition to his position with Owens-Illinois.

Mr. Fuller has been a member of the governing council of the bar association's Anti-Trust Section for the past three years and served last year as its vice chairman. He is a past member of the association's Anti-Trust Section for the past three years and served last year as its vice chairman. He is a past member of the associations House of Delegates.

He is an active member of the American Judicature Society, American Law Institute, and Ohio State Bar Association, where he serves as a member of the Corporation Law Committee.

KNOX GLASS APPOINTS A. W. LANSBERG

Dr. A. W. Wishart, president of Knox Glass, Inc., has announced the appointment of A. W. Lansberg to the position of treasurer and controller.

Mr. Lansberg brings to Knox Glass a broad background of experience in the field of finance. Immediately prior to his appointment with Knox, he was treasurer and controller of Plax Corp., Hartford, Conn., and prior to that he was vice president and treasurer of The Hartford Electric Steel Corp.

● George R. Frick is the recently appointed field representative in the Boston area for the L.O.F Glass Fibers Company, it was announced by J. M. Johns, Vice President and Director of Sales.

WISSCO *improved* LEHR belts

● **Heavy load capacity with less distortion...because of true guiding, flatness and flexibility of Wissco construction.**

● **Low thermal capacity, complete heat circulation and minimum surface contact of ware...because of open mesh.**

● **High resistance to heat and corrosion...because of wide choice of aluminized and low-chrome alloys.**

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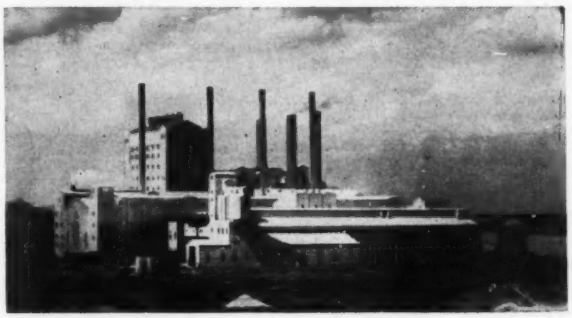
WISSCO BELTS

2688

Milestones in Glass Progress

PHOTO COURTESY THE CORNING MUSEUM OF GLASS

1792 The first fine glass produced in the U.S. was crafted at the factory of John F. Amelung, near Baltimore, Md. This Amelung goblet is made of clear glass, decorated by copper-wheel engraving, showing the owner's name surrounded by foliate wreaths. Broken years ago, it was restored and cherished as a family heirloom.



1890 Michigan Alkali Company, now a division of Wyandotte Chemicals Corporation, was founded by Captain I. B. Ford to supply Soda Ash to the glass industry; part of Wyandotte's modern Soda Ash facilities is shown above. Wyandotte has literally grown up with glass. Today, as in the past, it is a working partner, supplying technical assistance and raw-material chemicals to those great companies marking milestones in glass progress.

Wyandotte
CHEMICALS

Wyandotte Chemicals Corporation, Wyandotte, Michigan
Offices in Principal Cities

Founded by a Glassmaker to Serve the Glass Industry

New Equipment and Supplies

MICRO-FURNACE, MODEL MF-1

Elizabeth Instrument Company, Post Office Box 288, Elizabeth, New Jersey, is manufacturing a new micro-furnace, model MF-1. (See above).

It is particularly suited to ash fusion and melting point temperature determinations, phase studies in ceramics and metals, micro-separations, sintering studies and other high temperature investigations. The specimen is under direct observation by a stereoscopic microscope at all times.

Temperature readings are performed simultaneously, allowing accurate measurement of observable occurrences. The furnace will heat to 2000°F. in 45 minutes and stabilizes quickly at temperature. It requires no special training to install and operate.

The entire micro-furnace is self-contained and consists of the furnace unit, control console microscope and illuminator. The control console contains a pyrometer, ammeter and power control, with connections for external recorders or controllers. The microscope is stereoscopic with wide field objectives and paired achromatic eyepieces. A special illuminator directs light into the furnace, providing brilliant stereoscopic illumination of the specimen at all times.

AIR-POWERED STRAPPING MACHINE

Signode Steel Strapping Company, 2600 North Western Avenue, Dept. 9P, Chicago 47, Illinois, offers the first air-powered strapping machine that automatically tensions strapping and then seals and cuts it off in two easy motions. This semi-automatic model AP tool is power driven. It provides uniform, predetermined tension which may be adjusted up to 1600 pounds.

The Signode model AP tool is precision engineered to furnish high joint strength and is ruggedly built for low maintenance. It is designed for use with 5/8" or 3/4" Signode steel strapping. Due to its cast aluminum alloy base it is only a few pounds heavier than a hand operated seal feed tool. The loading magazine has a capacity of seventy-five seals.

NEW RADIATION DETECTOR

Minneapolis-Honeywell Regulator Company, Industrial Division, Wayne & Windrim Avenues, Philadelphia 44, Pennsylvania, has developed a new high-speed radiation detector which is five times faster than existing models.

The new unit responds to 98 per cent of any temperature change in less than a half-second. The temperature measurement can be accomplished without actually making physical contact. It is especially suited for temperature measurement of fast moving bars, billets and sheets which are "on target" for less than a second. It is also designed for applications where profile measurements determine temperature distribution along a moving slab, strip or sheet.

There are three models of the new high-speed unit available. One has a narrow sighting angle (20:1 ratio) for intermediate temperatures, covering the range from 800° to 1900°F. Other models have either a narrow angle (20:1 ratio), or a wide angle (7:1 ratio). Both cover the high temperature range from 1000° to 2600°F. The units are calibrated under black body conditions and are compensated for amient temperatures to 250°F. A complete line of accessories is available.

PLATE GLASS TRUCK

The Hamilton Caster & Manufacturing Company, 1700 Dixie Highway, Hamilton, Ohio, now offer a plate glass truck as an addition to their line of commercial and industrial trucks.

Built to handle large plate glass, the truck is specifically designed for glass plants, supply houses, building projects, etc., where safe and efficient handling and transporting of large, heavy glass is required. According to the company, it handles easily and turns in a minimum of space.

Of hardwood construction, the truck is equipped with heavy duty swivel casters and center load wheels, all with molded-on rubber tires and roller bearings. It is available in four standard sizes and can be custom built for specific job applications.

NEW ELECTRONIC SCANNING INSTRUMENT

The Robertshaw-Fulton Controls Company, 2920 North Fourth Street, Philadelphia, Pennsylvania, offers two new instruments of interest. A new electronic scanning instrument, designed for easy operation and simplified maintenance. The Fielden electronic scanner is capable of monitoring up to 25 control points and may be set in a matter of minutes by untrained personnel, using a bank of miniaturized slide wires.

Through an unusual system of pivot arms, hinges and sliding arms similar to the pull-out shelves in newer refrigerators, all decks of components and other wiring in the scanner are made easily accessible for easy and simplified maintenance.

The scanner is designed to check processes at a speed of either one point or five points a second. A unique built-in "memory" feature enables users to by-pass steps in the process that are not operating.

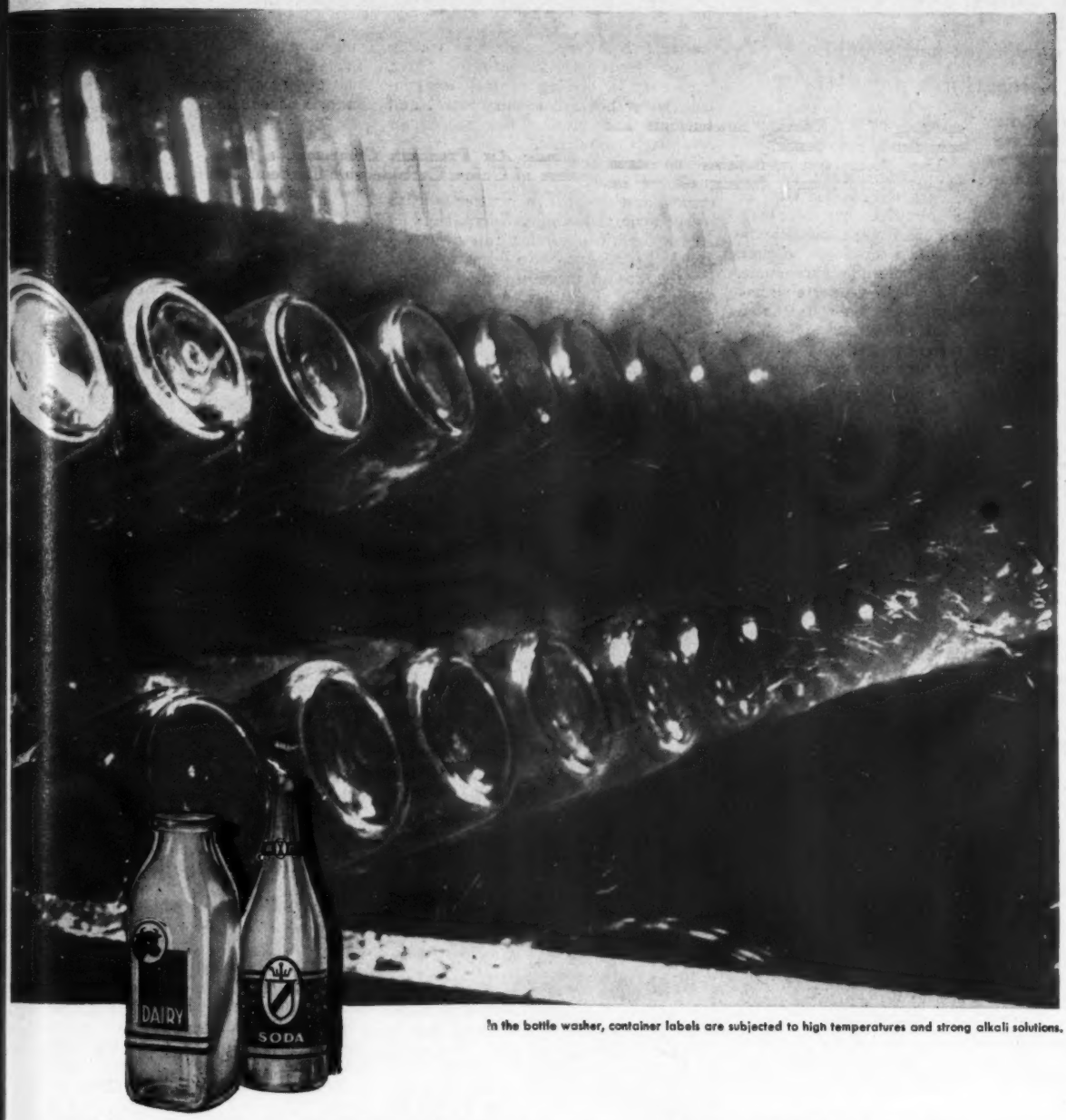
The first of these instruments now is in use in a jet engine plant, where it is utilized to check on gear box temperatures during final tests.

A spokesman for the company's Fielden Instrument Division, however, said, the new scanner may be used in any industrial or laboratory process to monitor variables including temperature, level, flow and pressure.

RESTORER MONITORS THERMOCOUPLES

The Peerless Electric Company, Electronics Division, Warren, Ohio, has announced a new product, the Restorer, for correcting inaccurate temperature reading and control

(*Continued on page* 546)



In the bottle washer, container labels are subjected to high temperatures and strong alkali solutions.

For excellent alkali resistance—use Du Pont Glass Colors

Washing with strong alkali and repeated sterilization can shorten the life of ordinary glass container labels, but not labels of Du Pont Glass Colors!

Durable Du Pont Colors withstand acids, alkali and continual sterilization. The smooth, even coats they produce are stable over a wide firing range . . . assure maximum coverage. Careful testing of each color before shipment assures you of uniformity and high quality.

Depend on Du Pont for a complete line of glass and ceramic colors: overglaze and underglaze, body, slip, glaze stains and squeegee oil. For complete information write E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

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BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

DU PONT GLASS COLORS

Equipment and Supplies . . .

(*Continued from page 544*)

caused by thermocouple circuit failure during heating treating and melting operations.

The Restorer's special electrical impulse renews proper conductivity in thermocouple circuits by breaking down excessive resistance caused by corroded, oil-soaked or loose circuit connections. This permits pyrometers and controls to obtain proper thermoelectric voltages from the couple and assures accurate temperature reading and control during heats.

The Restorer operates manually or automatically. It mounts on existing pyrometer panels or on its own central control panel when many thermocouples are monitored in an instrument room. One unit checks as many thermocouples as is desirable and practical.

The Protection Tube Leak-Checker warns against incorrect temperature reading or control caused by seepage of molten material into thermocouple protection tubes immersed in salt bath furnaces, open hearth baths and other melting furnaces. The Leak-Checker operates with the Restorer or independent of it.

NEW GLASS DRILLING MACHINE

Sommer and Maca Glass Machinery Company, 3600 South Oakley Avenue, Chicago 9, Illinois, has announced a newly designed 4-spindle automatic glass drilling machine for production drilling of mirror plates and other glass of similar sizes.

It is completely automatic, (air operated) with adjustable drill spindles (up to 36″ centers). The flow of coolant to each drill is automatically controlled. Only one operator is required for drilling two plates with two holes in each at one time. One concern reports one operator is drilling approximately 40 plates (4 holes in each), or 160 holes, per hour.

A WASHABLE ATOMIC CHART

Fisher Scientific, 717 Forbes Street, Pittsburgh 19, Pennsylvania, has announced a new edition of its simplified periodic chart of the elements, for use in offices and laboratories.

It is printed on Texoprint, a combination of fiber-and-plastic, with the printability of fine coated paper and the durability of cloth.

The new periodic chart will not curl, flake, or fray. It can be cleaned with soap and a damp cloth.

All atomic weights are corrected to conform with the 1952 international committee values.

FIRST COMPLETELY AUTOMATIC AUTOCLAVES

Philips & Davies, Inc., Kenton, Ohio, announces the first fully automatic Autoclave. These machines feature push-button operation with the timer, heat control, cycling control, air control, water control, steam control and opening and closing mechanism all completely automatic.

The Autoclave maintains constant pre-set temperature during all of its cycles and records a written record of each complete cycle. Silent, trouble-free hydraulic operation raises, lowers and locks the Autoclave lid as required by the pre-set cycle upon which the machine is operating. A special silicone rubber gasket gives a positive seal and prevents leakage.

In case of power failure, manual controls are provided to allow removal of the part being processed, in order to prevent spoilage. One man and a helper can operate up to a bank of 8 autoclaves.

ELEMENTAL BORON

The Pacific Coast Borax Company, Division of Borax Consolidated, Ltd., 100 Park Avenue, New York 17, N. Y., after two-and-a-half years of research work, has now started the manufacture of Elemental Boron on a pilot plant scale. From the beginning of their research program the production of Boron of 89 to 90 per cent purity has offered no difficulty. Their target was an amorphous Boron of much higher quality at a price for commercial quantities which would remove it from the class of laboratory curiosities to that of an industrial chemical.

The greater part of the laboratory's time was spent on process refinements which would yield a high quality product. Both objects have been achieved. Two grades of amorphous Boron, a low grade of 90 to 92 per cent,

CATALOGS RECEIVED

The Mullite Refractories Company, Shelton, Connecticut, has issued a new 24-page catalog on their "Shamva" Mullite brick and special shapes.

The catalog contains many illustrations of typical installations, as well as performance data, specifications, etc.

Columbia-Southern Chemical Corporation, Pittsburgh, Pennsylvania, has made available a new 18-page two-color brochure describing the manufacture and usage of Caustic Potash.

The booklet includes detailed procedures for unloading and precautions for handling. It contains complete technical data including specific gravity and density tables of solutions as well as temperature and alkali conversion tables.

Robertshaw-Fulton Controls Company, Fielden Instrument Division, has published a booklet which is aimed at helping industry and research installations find solutions to a wide variety of problems in precision measurement. It describes the proximity meter, an instrument which can detect a change in temperature of one thousandth of one degree centigrade, or variations as minute as one millionth of an inch.

Linde Air Products Company, a Division of Union Carbide and Carbon Corporation, 30 East 42 Street, New York 17, New York, has issued a 4-page catalog entitled, "Look to Linde for Silicones."

Listed are the various "Linde" silicones, in liquid and solid forms, in the broad categories of water repellents; oils and oil emulsions; electrical insulating resins; silicone rubber gum stock and compounds; anti-foaming materials, etc.

The Association of American Soap & Glycerine Producers, Inc., 295 Madison Avenue, New York 17, N. Y., have recently issued an informative booklet entitled, "The Prevention of Occupational Skin Diseases," by Louis Schwartz, M.D. Individual, free sample copies may be obtained direct from the Association. Bulk quantities will be supplied at cost and will be obtainable through member companies. For further information, the Cleanliness Bureau of the Association of American Soap & Glycerine Producers should be contacted.

Pittsburgh Corning Corporation, One Gateway Center, Pittsburgh 22, Pennsylvania, has issued a 4-page folder describing the recently introduced Duraface "Foamglas and has also published a new 8-page catalog, "Foamglas, the Cellular Stay-dry Insulation for Piping Equipment."

The new booklet presents the physical properties of the unique cellular glass insulation; sizes and shapes available and suggested thicknesses required for temperatures ranging from −50° to 800°F. Condensed recommended specifications and photographs of application make the booklet a reference for engineers, applicators and insulation contractors.

The Webb Corporation, Webb City, Missouri, has just released an informative 4-page folder on their various types of suspension hopper scales which are widely used for mixing, proportioning or batching of various ingredients in many industrial fields.

The scales are all steel construction, featuring hardened steel pivots and bearings (self-aligning). The scales can be equipped with dial indicators or with weigh beams as desired. The new brochure describes and illustrates a wide variety of styles and sizes of scales used in industries.

Mellon Institute, 4400 Fifth Avenue, Pittsburgh 13, Pa., announce the availability of a publication entitled, "Glass Fibers with Oriented Chain Molecules," by Martin Goldstein and T. H. Davis.

PERFORMANCE

Beyond the Life of the Tank...

with Kaiser Periclase Checker Brick!

DETAILED studies of continuous glass furnaces over the last 10 years show that:

A properly set installation of Kaiser Periclase Checker Brick can give top performance beyond the life of the tank.

Maximum MgO—95 per cent magnesium oxide.

Low porosity and minimum of connected voids—minimizes penetration and alteration of the brick by carryover.

High hot load strength and volume stability—makes possible deep settings of the brick without deformation of lower basic brick.

Flues stay open—these brick have a remarkable resistance to wetting; do not tend to accumulate carryover which normally clogs flues toward end of the campaign.

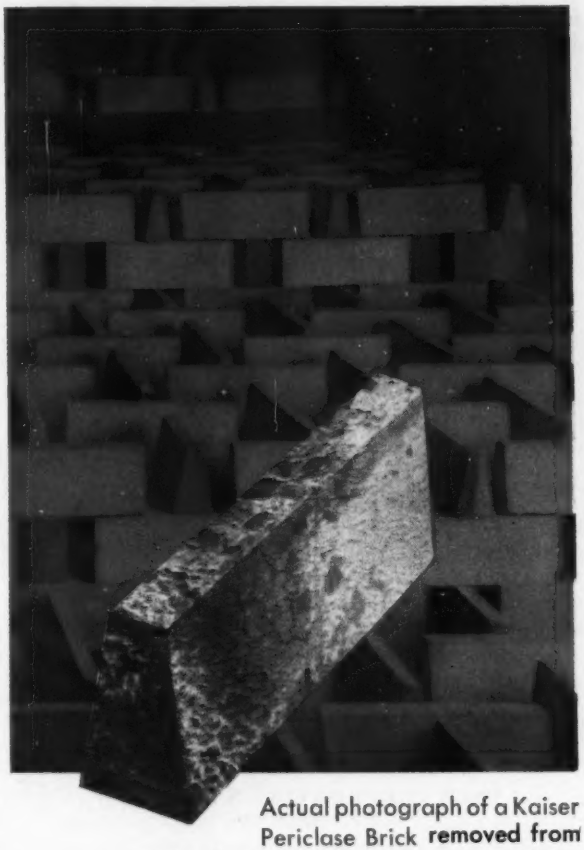
Minimum of incompatible impurities.

Retains thermal efficiency—Original thermal efficiency is two to three times greater than that of fire-clay. And tests prove this efficiency is *retained* throughout the campaign.

Accurate dimensions—permits absolutely level settings without the use of mortar or cutting. Assures a stable setting without shifting, slumping or sagging. Makes possible great savings in construction time.

For supporting data on how the superior characteristics of Kaiser Periclase Brick can increase the service life of your checkers, see our booklet, "A Report on a Better Basic Brick for the Glass Industry." If you don't have this valuable booklet, contact us for your free copy.

Call or write Kaiser Chemicals Division, *Kaiser Aluminum & Chemical Sales, Inc. Regional Sales Offices: 1924 Broadway,* OAKLAND *12, Calif. . . . 3 Gateway Center,* PITTSBURGH *22, Pa. . . . 518 Calumet Building, 5231 Hohman Ave., Hammond, Indiana* (CHICAGO).



Actual photograph of a Kaiser Periclase Brick **removed from a glass furnace after 1038 operating days. This particular brick was taken from under the hottest port in the furnace.**

For the ultimate in glass furnace checkers think of...

Kaiser Chemicals

Pioneers in Modern Basic Refractories

Refractory Brick and Ramming Materials • Dolomite • Magnesia • Magnesite • Aluminas • Periclase

AMERICAN POTASH TEXAS PLANT

Shown above are, left to right, Joseph C. Schumacher, director of research, D. S. Dinsmoor, vice president in charge of research and development, and Peter Colfax, president, studying plans for American Potash & Chemical Corporation's new American Lithium Chemicals, Inc. plant at San Antonio, Texas. The new $6,600,000 plant is now under construction and will be completed, according to schedule, late this year.

Stockpiling of Bikita lithium ore was begun in June, with the first shipment of nearly 11,000 tons. A continuing supply of lepidolite will be shipped from Bikita to San Antonio for processing into lithium hydroxide which will be distributed to lithium users.

American Potash & Chemical Corporation selected San Antonio as the site for the new lithium chemicals manufacturing plant after a search of areas both in Africa and the United States. Three main factors determined the site: availability of suitable limestone, adequate good water and an economical supply of fuel.

Also announced is the appointment of Roy MacLean, manufacturing process engineer, as general foreman in charge of production at San Antonio. Mr MacLean has been associated with American Potash & Chemical since 1944.

LYNCH CORPORATION NAMES NEW PRESIDENT

Will Freeman, chairman, announced that the board of directors of Lynch Corporation, Anderson, Indiana, have unanimously elected Elvin E. Hallander as president and a member of the board of directors.

Mr. Hallander comes to Lynch from the Trane Company of La Crosse, Wisconsin, where he was active in the management for the past six years. Prior to that, Mr. Hallander was president and general manager of the Star Electric Motor Company of Bloomfield, New Jersey, where he was active in engineering, sales and general management.

At the same time, it was announced by Mr. Will Freeman, that Mr. Lyman L. Campbell has been appointed as director of engineering and he will be in charge of engineering and development for both automatic packaging machines and glass forming machines.

Mr. Campbell recently served as manager of engineering at the Liquid Carbonic Company in Chicago where he headed an extensive research and development program of machinery allied to the bottling and packaging industries.

WILLIAM M. CLINES ELECTED

William M. Clines, western sales manager of heavy chemicals for American Potash & Chemical Corporation, has been elected president of the Chemical Research Market Association of Southern California.

The industry organization holds periodic sales meetings at which latest information is presented on new industries and products in Southern California and adjacent areas.

APPOINTMENTS AT STAUFFER

P. S. Brallier was named technical advisor to the president by Hans Stauffer, president, Stauffer Chemical Company. Mr. Brallier, who can count almost 40 years of service with the company, had been director of market research and development.

Mr. Stauffer also appointed A. N. Wohlwend, director of market research and development. Mr. Wohlwend moves up from the post of sales development manager.

The appointment of Robert U. Haslanger as director of industrial sales was announced by Hans Stauffer, president of the Stauffer Chemical Company.

Mr. Haslanger, who will continue to make his headquarters in New York City, had been eastern sales manager.

The appointment fills the vacancy created by the death, some months ago, of Mr. T. A. Haschke.

INTERNATIONAL MINERALS & CHEMICAL SHOWS INCREASED SALES, EARNINGS

For the sixteenth consecutive year, net sales of International Minerals & Chemical Corporation have shown an increase over the preceding year, according to the corporation's annual report for the fiscal year ended June 30, 1955, which was just released.

Net sales for the fiscal year were $96,485,017, the highest in International's history and 3.1 per cent higher than sales of $93,591,934 for the fiscal year ended June 30, 1954.

Net earnings of the corporation for the fiscal year ended June 30 were $6,321,903, compared with $6,043,979 for the preceding year. This was equivalent to $2.55 per share of common stock outstanding, compared with $2.44.

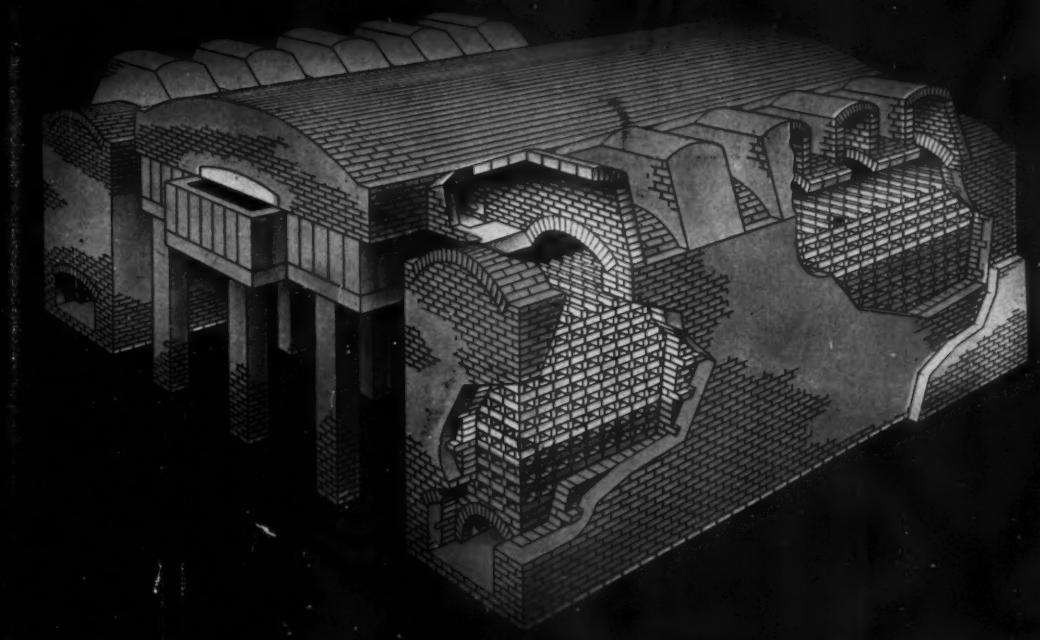
Earnings before income taxes amounted to $7,396,903 for the fiscal year ended June 30, compared with $7,113,979 for the preceding year.

F.M.C. CHEMICALS APPOINTS PUBLICITY MANAGER

Dr. Desmond M. C. Reilly has been appointed Sales Promotion and Publicity Manager for the Chemical Divisions of Food Machinery and Chemical Corporation, with headquarters in New York City.

Dr. Reilly received his Ph.D. degree from the National University of Ireland. He has been technical writer with the Chemical Divisions of Food Machinery and Chemical Corporation for the past two years.

Key Points Where It Pays to Specify B&W Specialized Refractories



Operators of glass melting furnaces know best the properties of refractories that they need in various tank locations.

Many manufacturers are choosing B&W Allmul, Allmul-D, B&W 80, 80-D and B&W Junior Firebrick for ports, checkers, regenerator crowns and walls. B&W Insulating Firebrick are also used for those sections of the tank that may require insulation.

Individual choice of a particular brand for a specific area varies, of course, with kind of glass melted, rate of pull, design of unit and other operating considerations. A container manufacturer found that B&W 80's were the most economical for specific checker locations, while another, producing tubing uses B&W Junior Firebrick in similar checker areas. B&W 80 Firebrick are used in burner blocks of a tank producing pressed ware, while manufacturers of borosilicate, container and window glass, for like applications, use B&W Allmul.

The one common requirement in all these applications is the uniform need for B&W *specialized refractories* to provide adequate performance.

For your next tank rebuild, we suggest calling in your B&W representative to get complete details.

Properties of B&W's Specialized Firebrick

	B&W Allmul	B&W Allmul-D	B&W 80	B&W 80-D	B&W Junior
Recommended use limit, F	3200	3200	2950	2950	2850
Fusion point, F	3335	3335	3190	3190	3173
Hot load strength, % deformation, 25 psi, 1½ hours	Less than 2% @ 3050F	Less than 1.2% @ 3050F	Less than 1% @ 2640F	Less than 0.5% @ 2640F	Less than 1.5% @ 2640F

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 161 EAST 42nd ST., NEW YORK 17, N.Y.
WORKS: AUGUSTA, GA.

B&W REFRACTORIES PRODUCTS: B&W Allmul Firebrick • B&W Silicon Carbide • B&W 80 Firebrick • B&W Junior Firebrick
B&W Insulating Firebrick • B&W Refractory Castables, Plastics and Mortars

(*Continued from page* 531)

core of 42 per cent nickel-iron coated with about 25 per cent of its weight of copper ("dumet") and has an expansion coefficient (0°—300°) of 90 x 10^{-7}. The overall thermal-contraction of the glass through which the lead wires are sealed must in fact match that of the lead-wire metal to within at least $\pm 4.10^{-7}$. For safety, the stem-glass supplier must guarantee a limit of about $\pm 2.10^{-7}$.

Another important requirement is that the cost of the glass must be as low as possible, consistent with technical requirements. From the thermal expansion point of view, a simple glass of a soda-lime-silica composition would serve for stem-making; however, although for many valves this would be satisfactory, there would be certain cases where high operating voltage and temperatures would actually decompose the glass by electrolysis. Lead glass is therefore used for stems. The D.C. electrical resistivity of lead glass at 150°, for instance, is of the order of 10^{12} ohms-cm. while soda-lime-silica glasses at the same temperature are generally around 10^{8} ohms-cm.

The glasses used for making electronic valves should be stable in the lamp-working flame. It is sometimes found that a prospective supplier's bulb glass devitrifies after some 15 seconds' flame-heating, or that a lead glass "boils" in the flame. Both devitrification and boiling seem to weaken the glass, making it "brittle" and are characteristic of the glass which should not be present.

The bulb is generally composed of soda-lime-silica glass instead of lead glass and it is important that the bulb and stem glass form a correct expansion match. It is found, in practice, that to give the best results the bulb should just lightly stretch the stem. If the stem contracts too much it becomes excessively stretched inside the bulb and tends to crack straight across the middle. On the other hand, if the bulb glass contracts too rapidly after sealing, it stretches itself around the stem and cracks radially at the joint. Glasses marketed for the bulbs and stems of miniature valves vary so much from supplier to supplier, however, by varying the combinations used, it is possible to make valves which will not fail from either of the above causes.

It is seen that, in practice, bulb and stem glasses with identical thermal expansion coefficients do not give the optimum matching. The key to the expansion lies, therefore, in considering the overall expansion properties, rather than the quoted figures, which always refer to the part of the curve below the transformation point. When a soda-lime-silica bulb envelope and a lead stem glass of equal expansion coefficient are sealed together, the lead glass, being softer, contracts the more rapidly at first, as it is cooled through its annealing range and this leaves a state of radial tension which is then maintained down to room temperature. Bulb glasses of slightly higher expansion coefficient contract faster and therefore, reduce this stress, excessively high bulb expansion reverses this stress and splits the bulb as described.

PITTSBURGH PLATE GLASS APPOINTS MANAGER FOR CUMBERLAND MARYLAND PLANT

Robert M. Hainsfurther has been appointed manager of Pittsburgh Plate Glass Company's $34,000,000 plate glass plant now under construction at Cumberland, Maryland, according to an announcement by Ralph V. Reisgen, general manager of plate glass production of the firm.

Following his graduation, Mr. Hainsfurther joined Pittsburgh Plate Glass as a trainee at the Creighton, Pennsylvania plate glass plant.

The last six years, Mr. Hainsfurther served as assistant plant manager and in that capacity has been in charge of plate glass manufacture at the Creighton plant.

Preliminary construction work on the Cumberland plant started last fall and foundations for the plant buildings are now being installed. Initial production from the new plant is expected by July, 1956.

THE BABCOCK & WILCOX COMPANY NAMES DIRECTOR OF STAFF

Carl Claus has been named director of staff of The Babcock & Wilcox Company, according to an announcement made recently by Alfred Iddles, president.

In his new position, Mr. Claus will coordinate the various staff functions of the company and will supervise the activities of the following departments and personnel: patent, New York office personnel, student recruitment and training, employee training, the director of purchasing, public relations advertising and publicity.

LITHIUM CORPORATION ANNOUNCES STAFF CHANGES

J. Dean Herman, chief chemical engineer, Gerald A. Munson, chief mineral engineer, and John Talley, Sr., branch manager, are the latest organizational changes to be announced by Herbert W. Rogers, president of Lithium Corporation of America, Inc.

Mr. Herman has returned to the Minneapolis office after serving at the firm's new Bessemer City, North Carolina chemical plant.

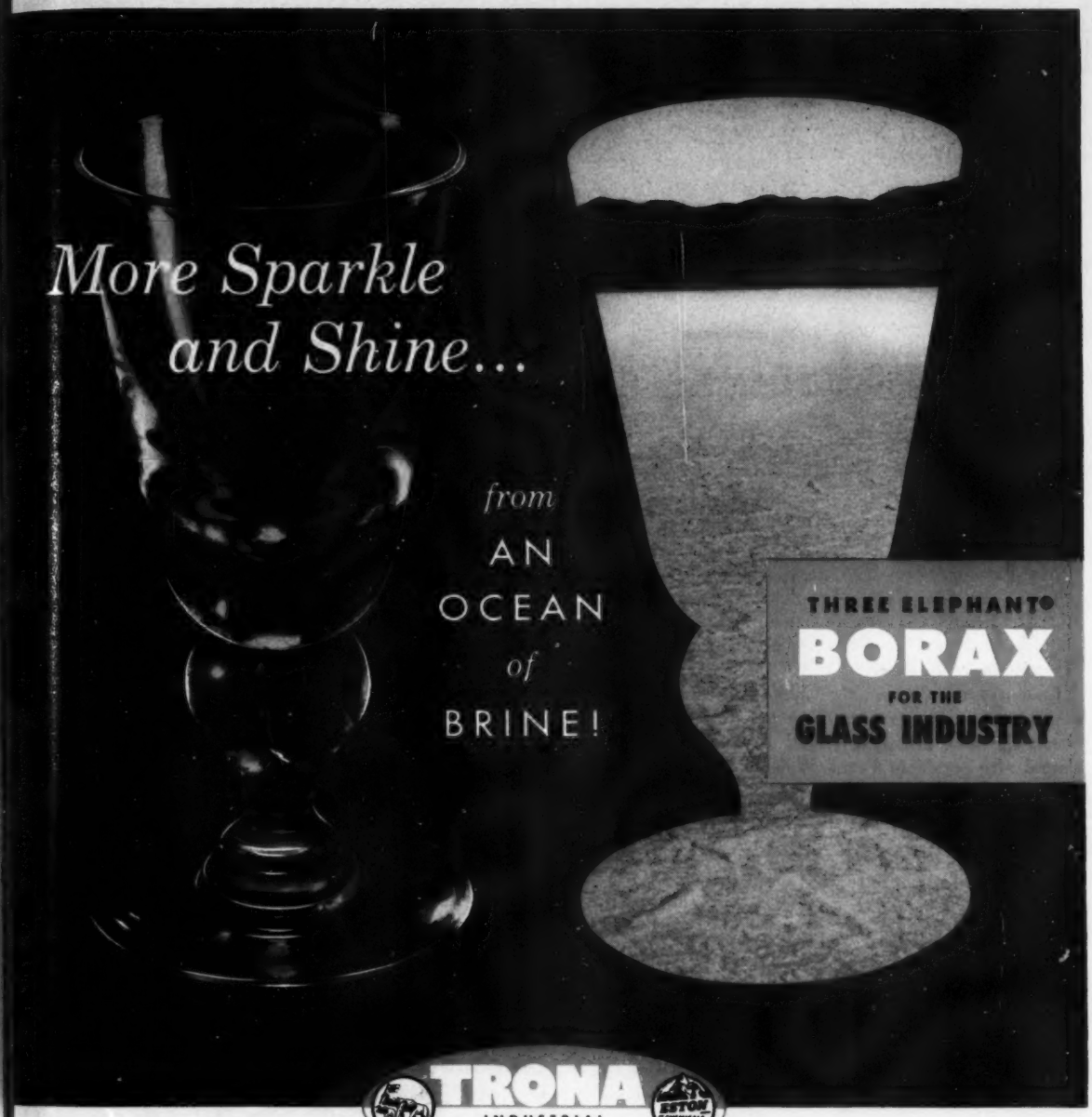
Mr. Munson has been transferred from the company's Hill City, South Dakota operations to Minneapolis, and will supervise Lithium Corporation's mining interests in the United States and Canada.

Mr. Talley has been appointed branch manager of the Black Hills operations, succeeding Munson. Mr. Talley boasts the longest service record in the company, having joined the firm at its inception in 1942.

LACLEDE-CHRISTY APPOINTS SALES REPRESENTATIVE

Kenneth S. Patton has been appointed sales representative for the Laclede-Christy Company, Division of H. K. Porter Company, Inc.

Mr. Patton will live in Oklahoma City and serve Laclede customers in Oklahoma, northern Texas, western Arkansas, and southern Kansas. Previously, Mr. Patton was with Mexico Refractories Company for ten years and is experienced with various kinds of refractory constructions and sales problems.



The glass industry looks to mineral-rich Searles Lake in California's Mojave Desert as its prime source of all-purpose borates. Whatever the product, soda-lime-silica glass or borosilicate ware, the presence of Three Elephant BORAX, BORIC ACID or PYROBOR®* in the batch imparts greater brilliance, strength, color and durability, speeds the melting process, reduces rejects and contributes to lower production costs. For better glass at lower cost, when planning current or future borate requirements be sure to call a Trona representative. There's an advantage in dealing with one of America's largest producers of boron chemicals for industry.

American Potash & Chemical Corporation

Offices	3030 West Sixth Street, Los Angeles 54, California
	99 Park Avenue, New York 16, New York
	214 Walton Building, Atlanta 3, Georgia
Plants	Trona and Los Angeles, California; San Antonio, Texas
Export Division	99 Park Avenue, New York 16, New York

***PYROBOR, dehydrated borax, $Na_2B_4O_7$**

BORAX • SODA ASH • SALT CAKE • POTASH • LITHIUM • BROMINE
and a diversified line of specialized AGRICULTRAL, REFRIGERANT and INDUSTRIAL CHEMICALS

WYANDOTTE CHEMICALS ELECTS VICE PRESIDENTS—FORMS NEW DIVISIONS

The board of directors of Wyandotte Chemicals elected Bert Cremers vice president and general manager of the new Michigan Alkali Division. In his new post, Mr. Cremers will be in charge of the divisional sales activities, as well as the manufacture of all Wyandotte's chemical products.

In 1942, Mr. Cremers was elected to the vice presidency of the sales division simultaneously with the consolidation of the Michigan Alkali Company and J. B. Ford Company to form the Wyandotte Chemicals Corporation. Prior to this, he had been manager of distribution, sales manager and director of sales for the Michigan Alkali Company.

Mr. Cremers served on the Chlorine-Alkali Subcommittee of the Army-Navy Munitions Board during World War II. He is a director and vice president of the Chlorine Institute and past trustee of the Glass Container Manufacturers Institute.

Concurrently, Wyandotte Chemicals Corporation announced the formation of three newly constituted divisions: the new Michigan Alkali Division, which newly elected vice president Frank Wolcott will head; the Research and Engineering Division, headed by the newly appointed vice president Frank Wolcott and the General Products Division, will be in charge of newly elected vice president and general manager, George W. Schwarz.

BALL BROTHERS APPOINTS DONALDSON

James W. Donaldson has been appointed by Ball Brothers Company, Inc., as general manager of the company's West Coast Division with headquarters at their El Monte, California, glass container and closure plant.

Before joining Ball Brothers last year, Mr. Donaldson was vice president and general sales manager of the Phillips Packing Company, Cambridge, Maryland, and prior to that was eastern sales executive for Standard Brands, Inc. Mr. Donaldson succeeds Hugh J. Crawford who, after 10 years with Ball Brothers, requested the change in management as a result of an extended illness.

When first associated with the Ball company, Mr. Crawford was assigned to the War Production Board where he served in various capacities as a dollar-a-year man during World War II. Since 1946, Mr. Crawford's efforts had been directed to the building of the Ball plant at El Monte and the development of their West Coast operations. Mr. Crawford will remain with the company in an advisory capacity at El Monte.

HARBISON-WALKER OPENS NEW SILICA PLANT

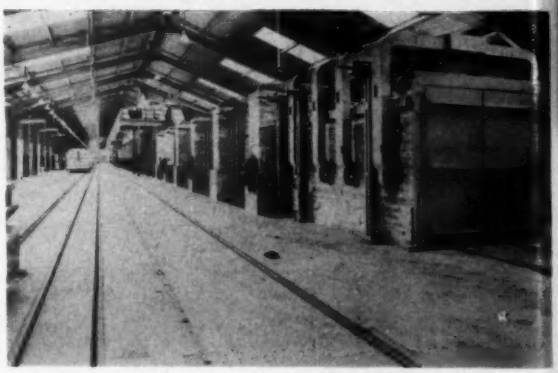
The Harbison-Walker Refractories Company has opened a new plant recently, for the manufacture of silica refractories, at Leslie, Maryland.

The plant site was selected for its proximity to raw material and to important consuming industries. The raw material originates in a quarry within a few miles of Leslie. The consumers are mainly located in the vicinity of Baltimore, Eastern Pennsylvania and other points near the Atlantic seaboard.

The plant is located about half-way between Baltimore and Philadelphia and is well situated for both railroad and truck shipments.

At the new Leslie plant, as at the comparatively new Windham, Ohio plant, two types of silica refractories are manufactured, the conventional class and the super-duty type.

This is the third silica brick plant built by Harbison-Walker since they introduced their original super-duty silica brick, during World War II.



The photograph above shows the seventh tunnel kiln built by Harbison-Walker for the burning of silica brick and is the 29th tunnel kiln to be put into operation in all the company's plants. It was completely designed by Harbison-Walker's engineering staff, taking full advantage of the experience of the operating department in working with the six other silica kilns at the company's plants.

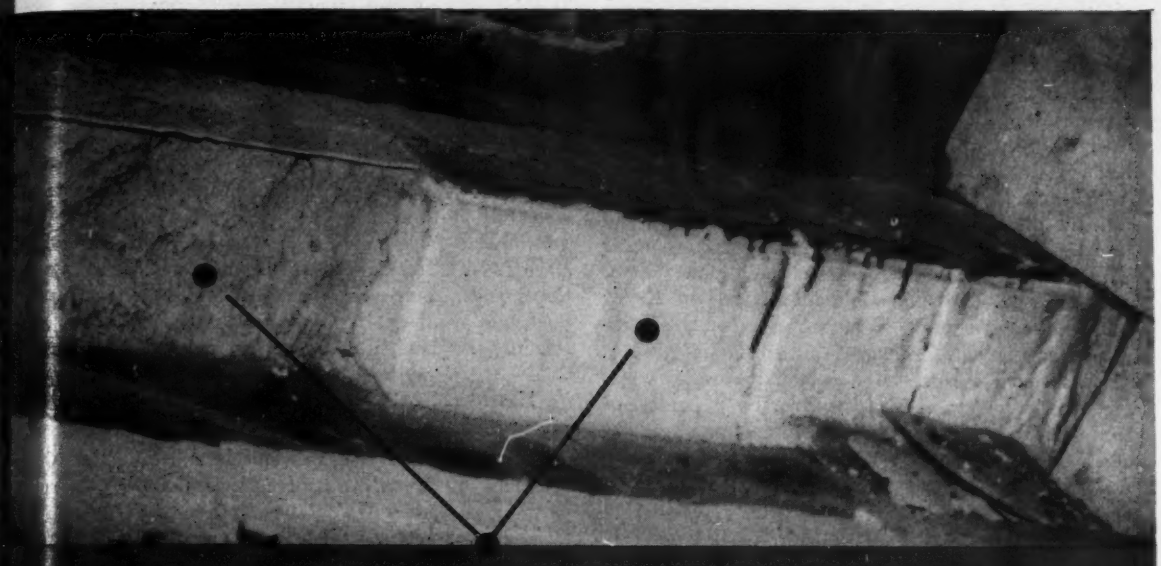
O-I APPOINTS MANAGER

The appointment of Edward H. Morse as manager of the Baltimore, Maryland, branch of the Glass Container Division, Owens-Illinois Glass Company, has been announced by Sidney F. Davis, vice president and division general sales manager.

Mr. Morse, with Owens-Illinois since 1933, has been a salesman in the Boston branch since 1939. He is a graduate of Bowdoin College. Mr. Morse succeeds the late Fern D. Weatherwax.

● Corning Glass Works will join seven other leading companies in building the world's first nuclear research reactor to be owned and operated by private industry, it was announced. The reactor will be used for atomic research in industrial and humanitarian fields.

FOR YOUR FEEDER CHANNELS



WHICH BLOCKS WOULD YOU PICK?

The ones next to the tank outlet, we'll wager. For these were chosen by the operator himself . . . to line 18 more complete feeder channels right up to the bowl!

Both materials were in use three years against flint bottle glass. Blocks in the more-favored position to the left are pitted and grooved badly. Considerable joint erosion also is evident. Their spongy appearance might indicate a source of stones or cords in the glass.

The right-hand MONOFRAX® M fused cast blocks present quite a contrast. Despite location in the hottest, most corrosive part of the channel, they are smooth and clean. There is no grooving or pitting.

Feeder channels fully lined with MONOFRAX M blocks should help keep glass quality high. And because of his selection this operator expects at least two full campaigns.

MONOFRAX M *materials are the most nearly pure of all commercial glass tank refractories. They consist of over 98% alumina, with less than 0.07% impurities, and next-to-no interstitial glass. Their dense, tightly-locked crystalline structure is especially resistant to erosion by molten glass, and their high degree of purity protects the color and quality of the finished product.*

CARBORUNDUM

Registered Trade Mark

The Carborundum Company
Dept. L105, Refractories Div.
Perth Amboy, N. J.

the trend is to **MONOFRAX®** **FUSED CAST** *refractories*

KELLEY ISLAND PROPERTIES SOLD

H. P. Eells, Jr., president of Basic Refractories, Inc., with general offices in Cleveland, Ohio, announced the purchase of the White Rock, Ohio, Gibsonburg, Ohio and Buffalo, N. Y. plants of the Kelley Island Company of Cleveland, together with related dolomite deposits, business, inventories, company name, patents and trademarks.

Kelley Island Company, the predecessor companies of which date back to 1886, was a pioneer in the manufacture of the lime products for which Northern Ohio is noted. The company's finishing lime, marketed under the long established and well-known trade name "Tiger Brand," is sold across the nation as is one of Kelley Island's newer products, "Kilnoise," a patented accoustical plaster which is demonstrating substantial growth. Mr. Eells stated that the Kelley Island properties and business was being obtained primarily in order ot extend Basic Refractories' activities in dolomite products into the building industry where Kelley Island has long occupied an important position. The Kelley Island properties will be operated as a separate division of Basic, under its present management, which consists of F. J. Collins, president, J. W. Rockwood, vice president, and E. J. Evans, secretary and treasurer.

WORK STARTS ON NEW NEPHELINE MILL

Construction work on an American Nepheline two-and-a-half million dollar expansion program is now under way. The new mill, which will more than double the present output, is being built at Nephton, Ontario, north of Peterborough. The additional capacity is required to meet the growing demand for the Company's product, "Lakefield" nepheline syenite, which is supplied to the glass, pottery and paint industries and is under test in other fields.

The construction program is being carried out by various contractors, working closely with American Nepheline personnel. Foundation Company of Canada is working on construction of storage silos, and concrete work is being done by Norcanda Construction Company. The contract for steel work has been awarded to Central Bridge Company and engineering work has been carried out by Kilborn Engineerig Ltd., in conjunction with the Company's engineering staff.

DIAMOND ALKALI ELECTS TREASURER

James A. Hughes, vice president and general manager of the Bryant Heater Division of Affiliated Gas Equipment, Inc., for the past five years, has been elected treasurer of Diamond Alkali Company, it was announced by John A. Sargent, president, following action by the Board of Directors.

Mr. Hughes succeeds Arthur W. Crossley, treasurer since July 1, 1948, who is leaving Diamond at an undetermined date, at which time he will announce his future plans.

To his new post at Diamond, Mr. Hughes brings a background of 15 years of business administration and general management experience in the shipbuilding, oil field supply and consumer goods industries. From 1940 to 1944, he was associated with the American Shipbuilding Company, Cleveland. Then he joined Dresser Industries, Inc. as an administrative executive, specializing in the fields of industrial relations and law.

DR. SILVERMAN IS HONORED

Dr. Alexander Silverman, Professor of Chemistry, Emeritus, in the University of Pittsburgh, was elected president of the Commission on Inorganic Nomenclature of the International Union of Pure and Applied Chemistry for a four-year term at the sessions in Zurich, Switzerland, July 20 to 27.

Professor Silverman has served on the Commission since 1947. Professor K. A. Jenson of the University of Copenhagen, Denmark, was elected vice president and Professor Geoffrey H. Chessman of the University of Reading, England, was re-elected secretary.

EMHART MANUFACTURING CO. ELECTS NEW OFFICERS

Francis R. O'Leary has been elected executive vice president of Emhart Manufacturing Company, a new post. With Curtiss-Wright Corporation since February, 1948, he has been a vice president of the Aviation concern and general manager of its Propeller Division.

Prior to joining Curtiss-Wright, Mr. O'Leary was general manager of the Ansco Division of General Aniline and Film Corp. and chief engineer and mechanical supereintendent of Chase Brass and Copper Company. He received his B.S. and M.S. degrees from M.I.T., both in electrical engineering.

At the same time Morton S. Cressy, general manager of Emhart's Hartford-Empire Company division, and J. Herbert Mosley, general manager of its Standard-Knapp division, were elected vice presidents of the parent company.

Mr. Cressy has been with Hartford-Empire since September, 1947, and was general sales manager of the division prior to being named general manager last year. Mr. Mosley joined Standard-Knapp in 1926 as a sales engineer and was in charge of engineering and manufacturing at the Portland factory until his appointment as general manager in 1954.

NEW STOCK TICKETS MARK SAFETY GLASS

Newly standardized stock tickets for identifying boxes of Libbey-Owens-Ford safety glass have been designed through the cooperation of H. Creston Doner, director of design, Melvin C. Koester, packaging engineer, and Miss Margaret Pilliod, color stylist, so that seven new tickets replace 34 varieties formerly used by various plants.

The new tickets are made in a triple-folded form so that one portion may be placed on each end of a box and a third retained as shipment record.

Color has been used for quick identification of the type of glass in the box. There is yellow for safety sheet glass, white for safety plate glass and a green stripe is used to designate E-Z Eye and green tint for shaded windshield. A light blue tint is used to note solid safety plate glass. A large space is provided for the part number and quantity, so that rapid inventory may be made of any shipment or stack of boxed glass.

does CAUSTIC SODA affect your future?

Today, with demands for chemicals growing by leaps and bounds, there's a way, more practical than crystal gazing, to see what the future holds.

Coordinated planning and production with Olin Mathieson assures the availability of chemical raw materials regardless of changing market conditions; assures adequate chemical production to supply growing industrial capacity; speeds the development of new chemical products and processes; provides greater flexibility in shipping and handling of materials; provides the personal attention of recognized product experts backed by widely diversified research facilities.

Today, more than ever, an association with an alert, aggressive chemical producer is essential to your future. Olin Mathieson's long experience and familiarity with the broad market picture will prove invaluable in your planning. Why not consult with us *now?*

MATHIESON

MATHIESON CHEMICALS
OLIN MATHIESON CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD.

3501

INORGANIC CHEMICALS: Ammonia • Bicarbonate of Soda • Carbon Dioxide • Caustic Soda • Chlorine • Hydrazine and Derivatives • Soda Ash
Hypochlorite Products • Nitrate of Soda • Nitric Acid • Sodium Chlorite Products • Sulphate of Alumina • Sulphur (Processed) • Sulphuric Acid

ORGANIC CHEMICALS: Ethylene Oxide • Ethylene Glycols • Polyethylene Glycols • Glycol Ether Solvents • Ethylene Dichloride • Dichloroethylether
Formaldehyde • Methanol • Sodium Methylate • Hexamine • Ethylene Diamine • Polyamines • Ethanolamines • Trichlorophenol • Trichlorobenzene

FIRST GORDON RESEARCH CONFERENCE HELD

The first Gordon Research Conference on glass was held at Kimble Union Academy, Meriden, New Hampshire, August 15 to 19 and had as its particular subject the structure of glass. The scientists participating in the conference arranged under the chairmanship of F. C. Flint, Hazel Atlas Glass Company, included those working in the fields of unusual inorganic glasses and organic high polymer glasses, as well as the more conventional silicate glasses and included representatives from England, Belgium, Norway, Japan and Sweden.

Research approaches discussed included the relatively direct investigation of structure by X-ray and neutron diffraction and electron microscopy, the investigation of glass transformation phenomena through measurements of heat capacity, viscosity, high pressure and ultrasonic effects. Theoretical treatments of the glassy transition particularly in polymers, raised considerable discussion of the applicability of these theories to inorganic glasses.

E. U. Condon, in conducting the final session of the conference given over to resume and conclusions, emphasized the lack of general agreement as well as the good prospects for clearing up much of the mystery of glass as he called upon various scientists for a five minute description of their current endeavors.

O. L. Anderson, Bell Telephone Laboratories, this year's vice chairman, was named chairman for next year with Harrison Davies, Mellon Institute as vice chairman. Other members of this year's committee were N. J. Kreidl and J. R. Hensler, Bausch & Lomb Optical Company.

COLUMBIA-SOUTHERN CHEMICAL SIGNS CONTRACT

Columbia Southern Chemical Corporation signed a five-year contract with the union at its Barberton, Ohio, plant. The firm believes that this is the first five-year contract signed by a major chemical producer.

A strike at the Ohio plant, which occurred upon termination of the previous labor contract, was ended when the hourly employees returned to work. E. T. Asplundh, president of Columbia-Southern, stated that the contract calls for a 6 per cent basic increase the first year and 3 per cent each of the following four years.

In addition, the contract calls for wage adjustments for skilled and semi-skilled employees, an improved pension plan providing for benefits of $2.00 per month for each year of service up to a maximum of 30 years and $80.00 disability benefits. It also calls for improved health and accident insurance, hospitalization benefits, a seventh paid holiday, an improved vacation plan and increased life insurance.

About 1,500 hourly employees, members of the Allied Chemical and Alkali Workers of America (Independent), are covered by the Barberton contract.

Mr. Asplundh said that the contract is not subject to reopening during the life of the agreement and it continues the no-strike clause which has been in effect since 1947. He went on to say that the long-term contract at Barberton reflected the firm's confidence in the continued growth of the nation's economy and the chemical industry's participation in a rapidly growing economy.

CLASSIFIED ADVERTISING

FOR SALE

Three Lynch Model L-10 machines. Operating at present but can be released immediately. Reply Box 181, c/o The Glass Industry, 55 W. 42 St., New York 36, N. Y.

HELP WANTED

WANTED: Experienced I.S. machine man to supervise the operation of a group of machines in a container plant. Experience with 62 process double cavity essential. We are looking for a man who can plan the operation from the start of the mould and machine equipment to the actual production of top quality ware. Our men know of this ad. Reply Box 179, c/o The Glass Industry, 55 W. 42 St., New York 36, N. Y.

WANTED: Experienced mould shop man for position as shift foreman in West Coast Glass Container Plant mould shop. Future possibilities excellent. Reply Box 180, c/o The Glass Industry, 55 W. 42 St., New York 36, N. Y.

JUNIOR GLASS TECHNOLOGIST with degree in glass or ceramics to work on related glass problem in cathode-ray tube industry. No experience necessary, but desirable. Contact Employment Office, Allen B. Du Mont Laboratories, Inc., 35 Market Street, East Paterson, New Jersey.

GLASS CONTAINER manufacturer has opening as Quality Control Supervisor. Experience Desirable. Reply in confidence, giving background and salary expected to Box 178, c/o Glass Industry, 55 West 42 Street, New York 36, N. Y.

DUNCAN & MILLER GLASS COMPANY BOUGHT BY U. S. GLASS COMPANY

The purchase of Duncan & Miller Glass Company of Washington, Pennsylvania, by the U. S. Glass Company, Tiffin, Ohio, has just been announced.

Part of the Duncan & Miller personnel will be retained by U. S. Glass Company and the operations of both companies will be separate and distinct.

NEW THATCHER GLASS APPOINTMENTS

The election of P. Stuart Holmquest as vice president in charge of container sales for the Thatcher Glass Manufacturing Company, Inc., was announced by William J. Green, executive vice president of the company.

In his new position, Mr. Holmquest will direct sales for all of Thatcher's container groups.

Prior to joining Thatcher, Mr. Holmquest was manager of Armstrong Cork Company's glass container department.

Harry J. Mullany, vice president and container factories manager of Thatcher Glass Manufacturing Company, Inc., Elmira, New York, announced the appointment of Andrew E. Mauro as manager of that company's Lawrenceburg, Indiana glass container plant.

Before assuming his new position, Mr. Mauro was director of Quality Control and Customer Service. He also had managed Thatcher's Elmira and Long Island plants.

Named to succeed Mr. Mauro was Clement N. Granoff, who was moved from his former position as manager of Quality Control and Customer Service for Thatcher's McKee Division.

Mr. Mullany also announced that S. W. Adair has joined Thatcher Glass as general production manager of the Elmira container plant.

Owens-Illinois Technical Center . . .

(Continued from page 520)

and approved.

(3) Operation of the theory, to test its manufacturing possibilities.

(4) Pilot plant operation, to test actual production on a limited, or prototype scale.

(5) Creation and testing of the actual machinery or product in commercial operation or production.

An important achievement of the O-I research team points up the significance of this integrated system. This is a recently perfected system for making glass containers at twice the present production rate. These containers are not only as strong as those now being manufactured, but they feature a 20 per cent reduction in weight.

The process was shown at the opening of the company's new technical center, where containers were produced on an experimental machine and visitors saw the machine actually producing the containers by the new method.

Twelve years of pioneering studies by Owens-Illinois engineers and scientists went into the perfection of the new process. It is based on the principle that glass behavior in the forming stage basically depends on how it cools.

The key to the new process, according to company officials, is control of the heat transfer from the glass, the instant the glass leaves the furnace until it finally is formed into a container.

"In short," an O-I representative said, "this process allows us to exercise complete control over distribution of glass in the mold during the forming stage. With it, we can decide how a container should be built to meet a specific packaging requirement, make the machine distribute the glass in that fashion and come up with exactly what was ordered."

The company expects the first use of the process to be in the production of wide-mouth jars, such as are used for food containers.

Owens-Illinois officials explained that, while it is still too early to forecast the full economic impact of the innovation, it is certain that the new container will have a large over-all influence on the packaging field. The savings in shipping costs alone already are apparent. This feature, along with other advantages, they said, undoubtedly will convince many manufacturers, formerly using other types of containers, to convert to glass.

Among other features of the exhibits seen by the educators, local and state officials and industrial research leaders who toured the new Center, was a heat-treating process for glass containers.

Also seen was a new low-temperature solder glass, which is already being used for experimental work on envelopes for color television picture tubes. The new glass permits joining of the faceplate of the tube to the cone portion by means of a glass seal, rather than metal, which had previously been used, and was quite bulky and unsatisfactory.

Visitors to the Center during the actual dedication day program were quite impressed with the modern facilities, the many points of interest from the solid state physics laboratory, starting point for O-I's glass structure studies, through others of the Center's fifty laboratories and into the pilot plant for demonstrations of actual research projects in final stages of experimental production.

It is hoped that a detailed description of the new O-I Technical Center can be presented in an early issue of THE GLASS INDUSTRY.

APPOINTMENTS AT L.O.F. GLASS FIBERS COMPANY

J. M. Johns, vice president and director of sales of the L.O.F Glass Fibers Company, Toledo, Ohio, announced the following appointments:

Chester E. Shepperly has been named district manager of the Boston area. Thomas D. Leathers has been appointed district manager of the Pittsburgh area. G. O. Hartzell has been named district manager of the Toledo area. James J. Secor, Jr. was made district sales manager of the Philadelphia area. Francis W. McPeek is the recently appointed district sales manager of the Cincinnati area. John A. Webb is the new field representative in the Philadelphia area. Don McAnally was appointed sales promotion manager. Thomas C. Walbridge will be the distributor sales representative in the Chicago regional office.

APPOINTMENTS AT CORNING GLASS

The appointment of Willard J. Thomas as division controller of the Technical Products Division of the Corning Glass Works was announced by Russell Brittingham, company vice president and general manager of the division. Mr. Thomas succeeds Eldon B. Sullivan who is leaving the company to enter Cornell University Law School this fall.

Stannard H. McKibben has been appointed supervisor of television bulb applications engineering and packaging in the Electrical Products Division, it was announced by John L. Hanigan, company vice president and general manager of the division.

R. Lee Waterman was recently appointed to the position of general manager of the Consumer Products Division of Corning Glass Works, it was announced by William C. Decker, company president. Mr. Waterman succeeds John Carter, vice president, who has been named general manager of Corning Glass Works New Products Division.

At the same time, it was announced that Thomas H. Truslow, Jr., former general manager of the New Products Division, has been named assistant to the president to work on special assignments.

CAMBRIDGE APPOINTS CREEL

Thomas M. Creel has been appointed sales engineer for the Cambridge Wire Cloth Company, Cambridge, Maryland, to cover the seven-state southeastern territory. Mr. Creel will represent the full Cambridge line.

● Richard M. Smith has been appointed supervisor of production and quality control for the Refractories Plant of Corning Glass Works, it was announced by R. Karl Smith, plant manager.

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